DIRECTION

13149A

CODE

11-1565

DENTAL X-RAY UNIT, MODEL GE-100

STATIONARY, MOBILE,
AND
REMOTE CONTROL TYPES

Installation - Adjustment - Maintenance

N

X-RAY DEPARTMENT
GENERAL ELECTRIC
COMPANY

TABLE OF CONTENTS

Title — Page

FOREWORD 1

PLANNING AN INSTALLATION 1
  Power Supply Requirements 1
  Voltage and Frequency 1
  Voltage Regulation 1
  Line Voltage Stability 1
  Suggested Wiring Layout For Remote Tube Heads 3
  Selection of Space 3
    Stationary Type 3
    Remote Type 3
    Mobile Type 4
    Unit Location 4

DAMAGE IN TRANSPORTATION 10

UNPACKING 10

TOOLS AND MATERIALS 10
  Tools and Meters 10
  Materials 10

MECHANICAL ASSEMBLY 13
  Stationary Control 13
    Adjustment of Extension Column 13
  Remote Floor Control 15
    Optional Tube Head Selector Switch 15
  Remote Compact Control 15
  Mobile Control 16
    Adjustment of Extension Column 16
    Folding Bracket 16
    Limiting Bracket Extension 16
  Mounting Vertical Column For Remote Tube Head 16
  Mounting Wall Plate For Remote Tube Head 17
  Installing Bracket 17
  Tube Head 18
  Cone 19

MECHANICAL TEST AND ADJUSTMENT 19

ELECTRICAL CONNECTIONS 20
  Conduit Installation For Remote Tube Heads 20
  Grounding 20
  Line Connections (Conduit) 20
  Line Connections (No Conduit) 20
  Hand Switch Connections 20
  Head Cable Connections At The Control 21
    Stationary And Mobile Controls 21
    Remote Floor Control 21
    Multiple Tube Heads 21
    Remote Compact Control 21
  Head Cable Connections At Bracket 21

ELECTRICAL TEST AND ADJUSTMENT 21
  Line Voltage Adjustment 21
  Voltage Regulation Adjustment 22
  Stabilizer Check and Adjustment 22
  Timer Check 22

COMPLETION OF INSTALLATION 22

MAINTENANCE 22
  Line Switch 23
  Primary Fuse 23
  Pilot Lights 23
  KVP Meter 23
  X-Ray Contactor 23

TABLE OF CONTENTS (CONT'D)

Title | Page

MAINTENANCE (CONT'D)
- Stabilizer 23
  - Stabilizer Check 23
  - Stabilizer Adjustment (One Tube Head Only) 24
  - Stabilizer Adjustment (Multiple Tube Heads) 24
- Timer 26
  - Timer Check 26
  - Timer Adjustment 26
  - Timer Function 27
  - Timer Trouble Shooting Procedure 27
- Tube Head 27

OPERATION AND TECHNICS 27

DENTAL X-RAY UNIT, MODEL GE-100

STATIONARY, MOBILE,
AND
REMOTE CONTROL TYPES

Installation - Adjustment - Maintenance

Direction 13149A

1. This Direction will serve as a guide for installing, adjusting, and operating the GE-100 Stationary, Mobile and Remote Control Dental X-Ray Units. The Direction covers Remote operated units using a Floor or Wall Mounted Control and equipped with a Vertical Column or a Wall Bracket Support.

2. The direction provides the necessary information required to make the installation. If assistance is required, call upon the nearest office of the General Electric Company, X-Ray Department, whose personnel have been especially trained in this type of work.

3. The Model GE-100 is designed for operation from a 115 volt, 50 to 60 cycle power source. An adapter autotransformer is available separately for operating the unit from a 230-volt AC power supply. The information for making the conversion is included with the autotransformer.

4. Before attempting to proceed with the installation, read the direction thoroughly and follow the recommended installation procedure.

PLANNING AN INSTALLATION

POWER SUPPLY REQUIREMENTS

5. For proper operation the power source must be of proper voltage, frequency and voltage regulation as indicated below:

VOLTAGE AND FREQUENCY

6. The voltage range for the GE-100 is 100-130 volts or 200-260 volts (for units with a 230 to 115 volt step-down autotransformer) and the frequency is 50 to 60 cycles. The line voltage can be checked with an a-c voltmeter. The line frequency, if unknown, can be obtained from the local electric power company.

VOLTAGE REGULATION

7. The unit draws 2.1 kva (18 amperes at 115 volts or 9 amperes at 230 volts) at power factor of 65%. The power supply which is to deliver this load must have a voltage regulation that does not exceed a certain limit. In many cases any wall outlet in a building with modern electrical wiring will be found suitable. However, the ability of the power supply must be determined at the time of the installation or calculated before the installation by a qualified person. If the voltage regulation is outside the limit specified below, larger wires must be installed.

8. The preferred voltage regulation is 5% or less although the unit will operate satisfactorily at as high a voltage regulation as 10%.

9. Whenever a load is thrown on a power supply, a voltage drop takes place, the magnitude of which depends on the capacity of the power transformer supplying power to the building and the sizes and lengths of all line conductors from the transformer to the X-ray unit. The accepted way of expressing the voltage drop is in terms of voltage regulation. For instance, if the voltage drop is 11 volts when the line voltage under load is 110 volts, the voltage regulation is 11/110 = 10%.

LINE VOLTAGE STABILITY

10. The line voltage often varies during the day. Gradual voltage variations of a sustained nature can be compensated by means of the kvp Selector on the control panel as long as their magnitude is within the voltage range of the unit. Instantaneous voltage variations may result from heavy loads such as elevators, air conditioning equipment, etc. Their duration varies from a fraction of a second to a few seconds, and they cannot be compensated for. If excessive in magnitude, they will cause films of varying density

THE LENGTH OF CONDUIT AND TYPES OF FITTINGS USED FOR ELECTRICAL CONNECTIONS BETWEEN THE BRACKET SUPPORT AND THE CONTROL WILL DEPEND ON THE INDIVIDUAL INSTALLATION. SUFFICIENT CONDUIT, EITHER RIGID OR FLEXIBLE, WALL BOXES AND PROPER FITTINGS MUST BE OBTAINED LOCALLY. THESE, OF COURSE, SHOULD MEET STANDARDS ESTABLISHED BY LOCAL ELECTRICAL CODES AND NATIONAL BUREAU OF STANDARDS HANDBOOK, 76. FIVE INTERCONNECTING WIRES ARE REQUIRED IN THE CONDUIT AND THEIR SIZE WILL DEPEND ON THE LENGTH OF THE RUN. THE RECOMMENDED SIZES FOR VARIOUS RUNS CAN BE FOUND BELOW. WHEN THE INTERCONNECTING WIRES ARE RUN IN CONDUIT, ALL LEADS GOING TO THE CONTROL MUST BE IN CONDUIT AND A FUSED LINE SAFETY SWITCH OR CIRCUIT BREAKER MUST BE INSTALLED. A LINE CORD AND WALL RECEPTACLE MAY BE USED IF THE BRACKET CABLES ARE CONNECTED DIRECTLY TO THE CONTROL.

JUNCTION BOX #1 - FOR CONCEALED WIRING LOCATE 50" FROM FINISHED FLOOR TO HORIZONTAL CENTER FLUSH WITH FINISHED WALL.

JUNCTION BOX #2 - ALTERNATE - CONVENIENCE OUTLET- WALL PLATE FOLDING BRACKET SUPPORT CABLES WILL REACH THIS POINT. BOX APPROXIMATELY 12" FROM FLOOR.

JUNCTION BOX #3- LOCATE NEXT TO FLOOR CONTROL APPROXIMATELY 12" FROM FLOOR.

JUNCTION BOX #4 - LOCATE BEHIND OR BELOW COMPACT CONTROL - IF BEHIND CONTROL HORIZONTAL CENTER OF BOX SHOULD BE 52" FROM THE FLOOR - IF BELOW CONTROL HORIZONTAL CENTER OF BOX SHOULD BE 48" FROM THE FLOOR.

JUNCTION BOX #5 - LOCATE NEXT TO VERTICAL COLUMN 12" FROM FLOOR.

POWER OUTLET RECEPTACLE - LOCATE NEAR CONTROL UNIT

LINE SAFETY SWITCH - LOCATE NEAR CONTROL UNIT

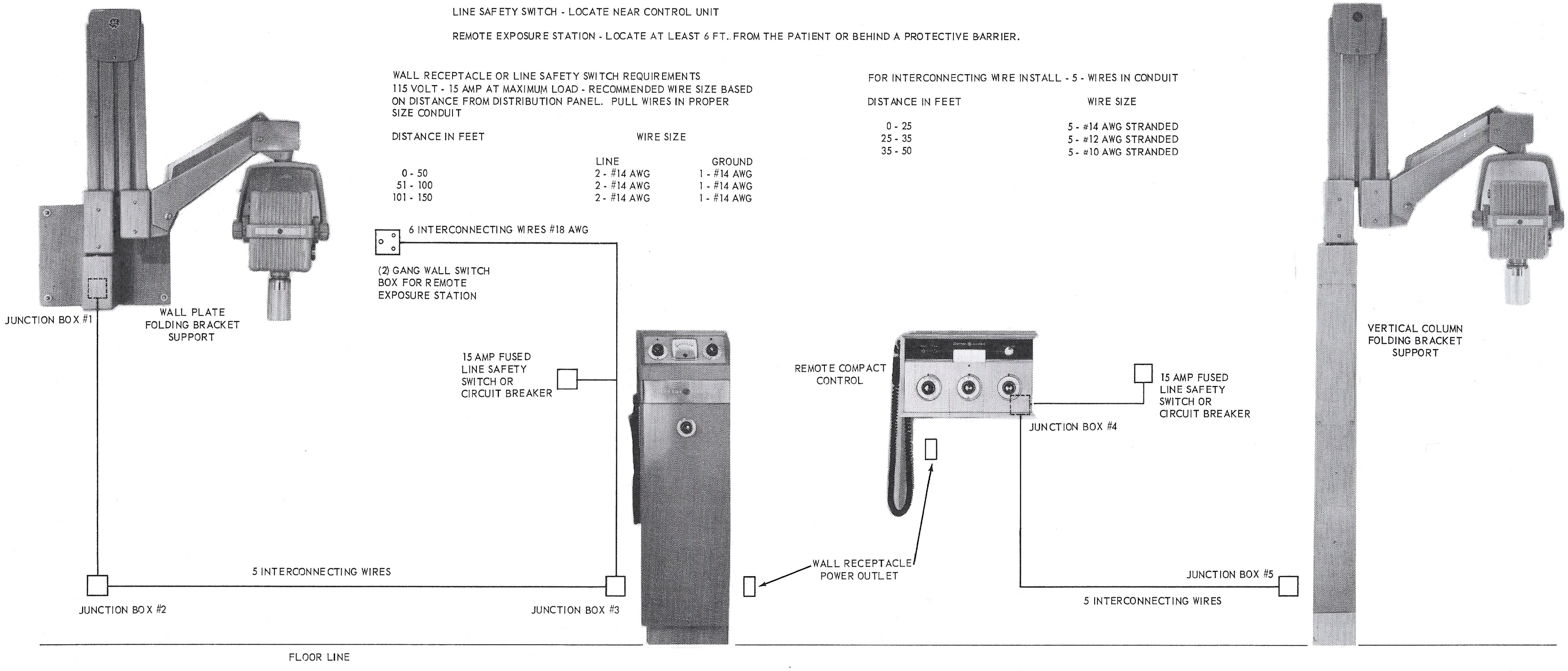
REMOTE EXPOSURE STATION - LOCATE AT LEAST 6 FT. FROM THE PATIENT OR BEHIND A PROTECTIVE BARRIER.

WALL RECEPTACLE OR LINE SAFETY SWITCH REQUIREMENTS
115 VOLT - 15 AMP AT MAXIMUM LOAD - RECOMMENDED WIRE SIZE BASED ON DISTANCE FROM DISTRIBUTION PANEL. PULL WIRES IN PROPER SIZE CONDUIT

DISTANCE IN FEET	WIRE SIZE	
	LINE	GROUND
0 - 50	2 - #14 AWG	1 - #14 AWG
51 - 100	2 - #14 AWG	1 - #14 AWG
101 - 150	2 - #14 AWG	1 - #14 AWG

FOR INTERCONNECTING WIRE INSTALL - 5 - WIRES IN CONDUIT

DISTANCE IN FEET	WIRE SIZE
0 - 25	5 - #14 AWG STRANDED
25 - 35	5 - #12 AWG STRANDED
35 - 50	5 - #10 AWG STRANDED



6 INTERCONNECTING WIRES #18 AWG
(2) GANG WALL SWITCH BOX FOR REMOTE EXPOSURE STATION
JUNCTION BOX #1
WALL PLATE FOLDING BRACKET SUPPORT
15 AMP FUSED LINE SAFETY SWITCH OR CIRCUIT BREAKER
REMOTE COMPACT CONTROL
15 AMP FUSED LINE SAFETY SWITCH OR CIRCUIT BREAKER
JUNCTION BOX #4
VERTICAL COLUMN FOLDING BRACKET SUPPORT
WALL RECEPTACLE POWER OUTLET
5 INTERCONNECTING WIRES
JUNCTION BOX #2
JUNCTION BOX #3
JUNCTION BOX #5
5 INTERCONNECTING WIRES
FLOOR LINE
9383-D31

TYPICAL WIRING LAYOUT FOR GE-100
REMOTE TUBE HEAD INSTALLATION

ILLUSTRATION 1

and may, under certain conditions, lead to excessively high voltage stress or sparking in the head. For best results, the instantaneous voltage variations should not exceed 3% of the line voltage.

SUGGESTED WIRING LAYOUT FOR REMOTE TUBE HEADS

11. The length of conduit and types of fittings used for electrical connections between the bracket support and the Control will depend on the individual installation. Sufficient conduit, either rigid or flexible, wall boxes and proper fittings must be obtained locally. These, of course, should meet standards established by local electrical codes and National Bureau of Standards Handbook 76. Five interconnecting wires are required in the conduit and their size will depend on the length of the run. The recommended sizes for various runs can be found below. When the interconnecting wires are run in conduit, all leads going to the Control must be in conduit and a fused line safety switch or circuit breaker must be installed. A line cord and wall receptacle may be used if the bracket cables are connected directly to the Control.

SELECTION OF SPACE

12. Location of the GE-100 in a given space must receive proper consideration prior to the installation.

Stationary Type

13. Location of the control housing with respect to the dental chair is very important in order to obtain unrestricted movement of the tube head for the entire range of standard dental technics. It is strongly recommended that the control housing be affixed to both floor and wall. This method of support will provide maximum stability and will seldom require alterations of the existing construction.

14. The alternate method of fastening the unit to the floor only will require careful consideration of the ability of the floor to withstand the forces exerted on it when the folding bracket is at its maximum extension. The General Electric Company, X-Ray Department will be glad to assist in these cases provided that full data on type of floor construction is furnished.

15. For 8-inch target-skin radiography (with a short cone) the choice of location is wide; for 16-inch focal spot-skin radiography (with a long cone) it is limited. Therefore, if short and long cones are to be used interchangeably or if the long cone is to be added at some future time, select the location on the basis of the long cone.

16. Certain factors within the room itself may have a definite bearing on the location of the housing. These factors should receive prime consideration when planning the installation, and room alterations made if needed.

17. Natural obstacles that must be considered are windows and doorways, radiators, columns, and dental equipment. Diagrams, Ill. 2 and 3 will aid in quickly determining one or several possible locations that will be acceptable.

18. Type of construction with particular reference to the proposed site should then be explored. Bear in mind that the recommended method is to fasten the control housing to both the floor and wall. If there is any doubt about the ability of the wall to withstand 65 lbs horizontal pull, consult the architect or building engineer. (Above figure includes a safety factor.)

Remote Type

19. Location of the wall plate or vertical column with respect to the dental chair is very important in order to obtain the unrestricted movement of the tube head for the entire range of standard dental technics.

20. For 8-inch target-skin radiography (with a short cone) the choice of location is wide; for 16-inch focal spot-skin radiography (with a long cone) it is limited. Therefore, if short and long cones are to be used interchangeably or if the long cone is to be added at some future time, select the location on the basis of the long cone.

21. Certain factors within the room itself may have a definite bearing on the location of the bracket support. These factors should receive prime consideration when planning the installation, and room alterations made if needed.

22. Natural obstacles that must be considered are windows and doorways, radiators, columns, and dental equipment. Diagrams, Ills. 6, 7, 8 and 9 will aid in determining one or several possible locations that will be acceptable.

23. Type of construction with particular reference to the proposed site should then be explored. Bear in mind that the vertical column must be affixed to both the floor and wall. If there is any doubt about the ability of the wall to withstand 210 lbs horizontal pull (about 70 lbs. per bolt for vertical column, 100 lbs per bolt for wall plate) consult the architect or building engineer. (Above figures include a safety factor.)

24. In general, most types of wall construction will fall into these classes:

a. Plaster Wall (on Wood Studs)

The plaster is not strong enough to support the horizontal pull of 65 lbs. Locate by tapping on the wall or other means the nearest wall stud and refer to the diagrams, Ill. 1 and 2, to determine whether the housing can be mounted at that location without limiting the range of the tube head movement. If not, arrange for reinforcing the plaster wall with wood braces, metal plate, or some other means. Lag screws will be found most suitable for mounting to plaster walls.

b. Solid Masonry Walls (Concrete or Brick)

Solid masonry walls should present no problems other than drilling holes for lead anchor bolts.

c. Hollow Masonry Walls (Concrete or Clay Tile)

In most cases hollow masonry walls will be found suitable. Toggle bolts can be used in holes drilled through the thin section of concrete blocks and lead anchor bolts used if the holes are drilled through block partitions.

d. Plaster Block Walls

Since this material is brittle it is recommended that holes be drilled through the wall and ordinary machine screws or bolts be used. Reinforce the rear side with a metal plate.

Mobile Type

25. There should be sufficient space to maneuver the mobile unit in order to provide for the entire range of standard dental technics. Refer to the dimensional drawing, Ill. 10, for data on the floor area occupied by the mobile base and other dimensions influencing the location of this unit.

26. Also note that the overall maximum extension of the folding bracket is restricted to 64-3/4" as compared to 84-3/4" for the stationary type.

Unit Location

ILLUSTRATIONS	DESCRIPTION
2,3	Stationary Control
4,5	Remote Controls
6,7	Wall Bracket
8,9	Vertical Column
10	Mobile Control

27. The dimensions in Illustrations 2, 6, and 8 are for the 8" radiographic cone. The minimum dimension represents a condition where the bracket is folded and the distal arm is slightly extended so that the axis of the tube head is located 12" down from its parked position. The tube head is horizontal as shown.

28. The maximum dimension represents a condition similar to that above except that the bracket is fully extended.

29. When the 16" radiographic cone is used add 8" to the minimum dimension and subtract 8" from the maximum dimension.

30. In general, for 8" and 16" radiographic technics, maximum flexibility and range is obtained when the control is located in an area to the rear of the dental chair or in an arc of approximately 45 degrees to the left of the rear position.

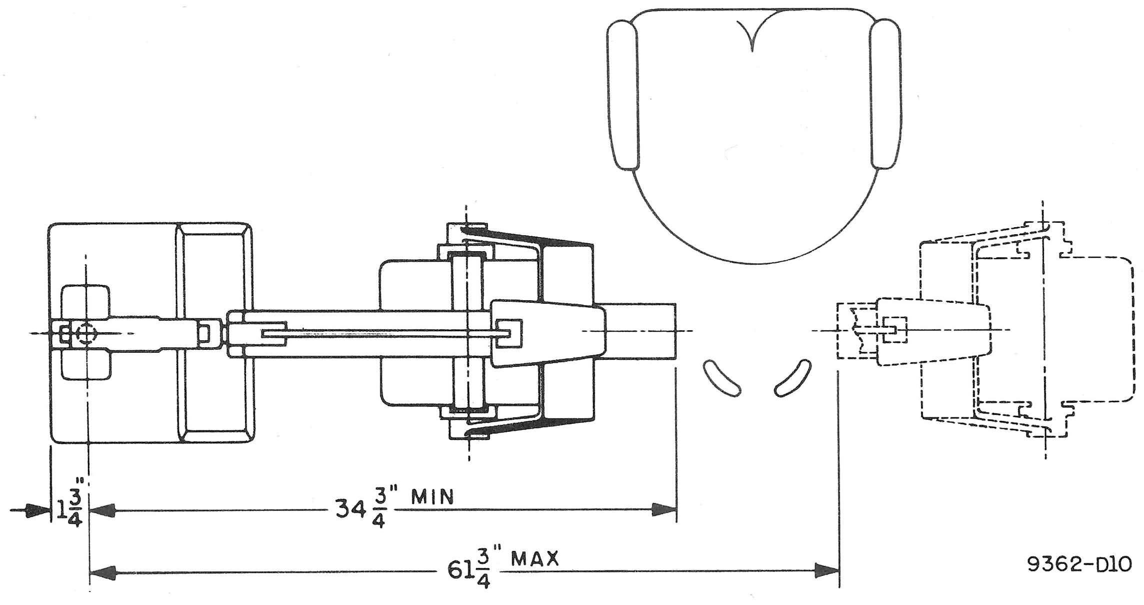
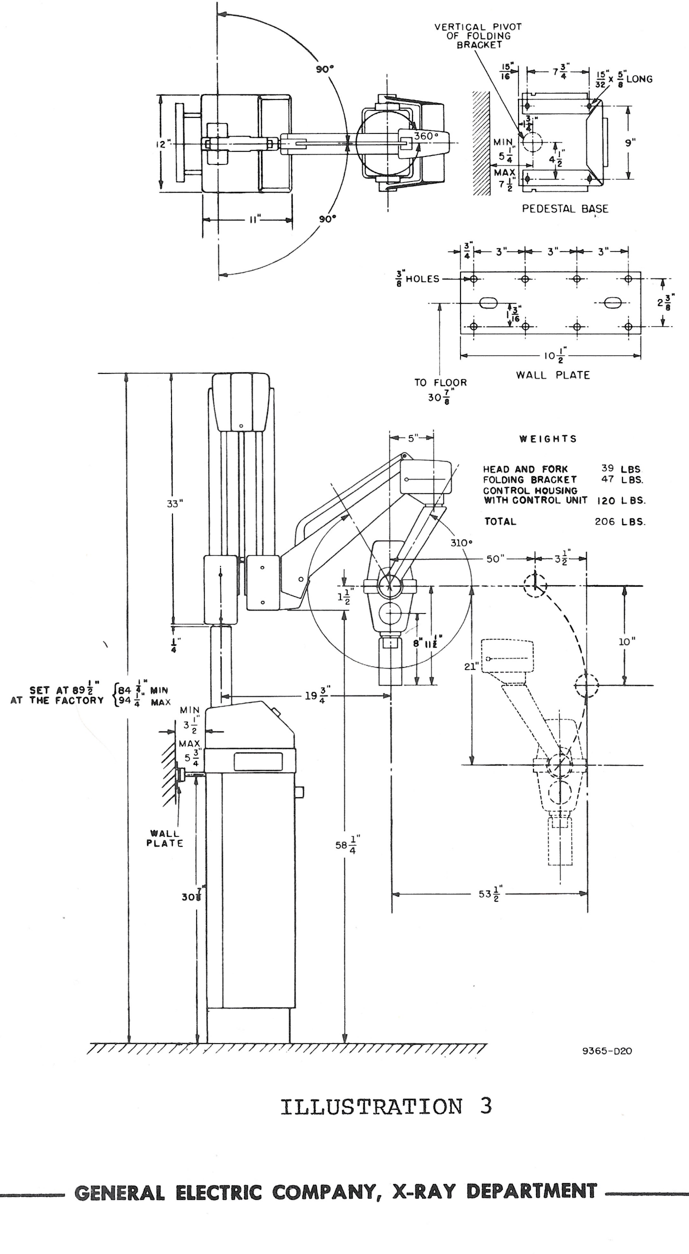

1 3/4"
34 3/4" MIN
61 3/4" MAX
9362-D10

ILLUSTRATION 2


90°
90°
12"
11"
360°
VERTICAL PIVOT OF FOLDING BRACKET
15/16"
7 3/4"
15/32" x 5/8" LONG
1 3/4"
MIN 5 1/4"
MAX 7 1/2"
4 1/2"
9"
PEDESTAL BASE
3/4"
3"
3"
3"
3/8" HOLES
1 3/16"
2 3/8"
10 1/2"
WALL PLATE
TO FLOOR 30 7/8"
5"
33"
310°
50"
3 1/2"
1 1/2"
8"
11 1/2"
10"
21"
1/4"
SET AT 89 1/2" AT THE FACTORY
84 1/4" MIN
94 1/4" MAX
19 3/4"
MIN 3 1/2"
MAX 5 3/4"
WALL PLATE
30 7/8"
58 1/4"
53 1/2"
9365-D20

WEIGHTS

HEAD AND FORK	39 LBS.
FOLDING BRACKET	47 LBS.
CONTROL HOUSING WITH CONTROL UNIT	120 LBS.
TOTAL	206 LBS.

ILLUSTRATION 3

SUGGESTED LOCATION FOR
*JUNCTION BOX FOR INCOMING POWER SUPPLY
**JUNCTION BOX FOR HEAD CABLE

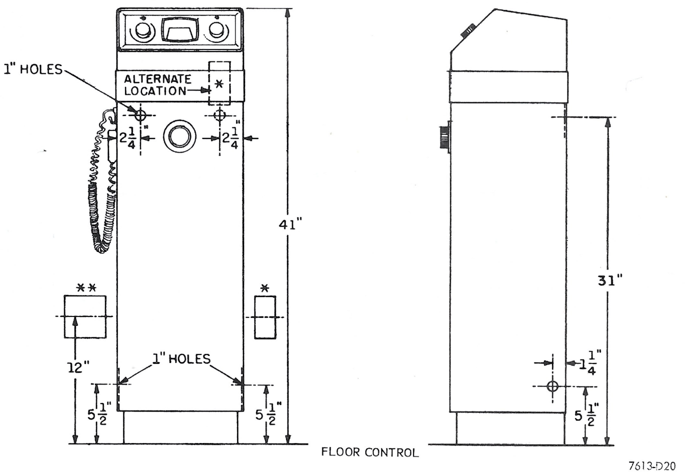
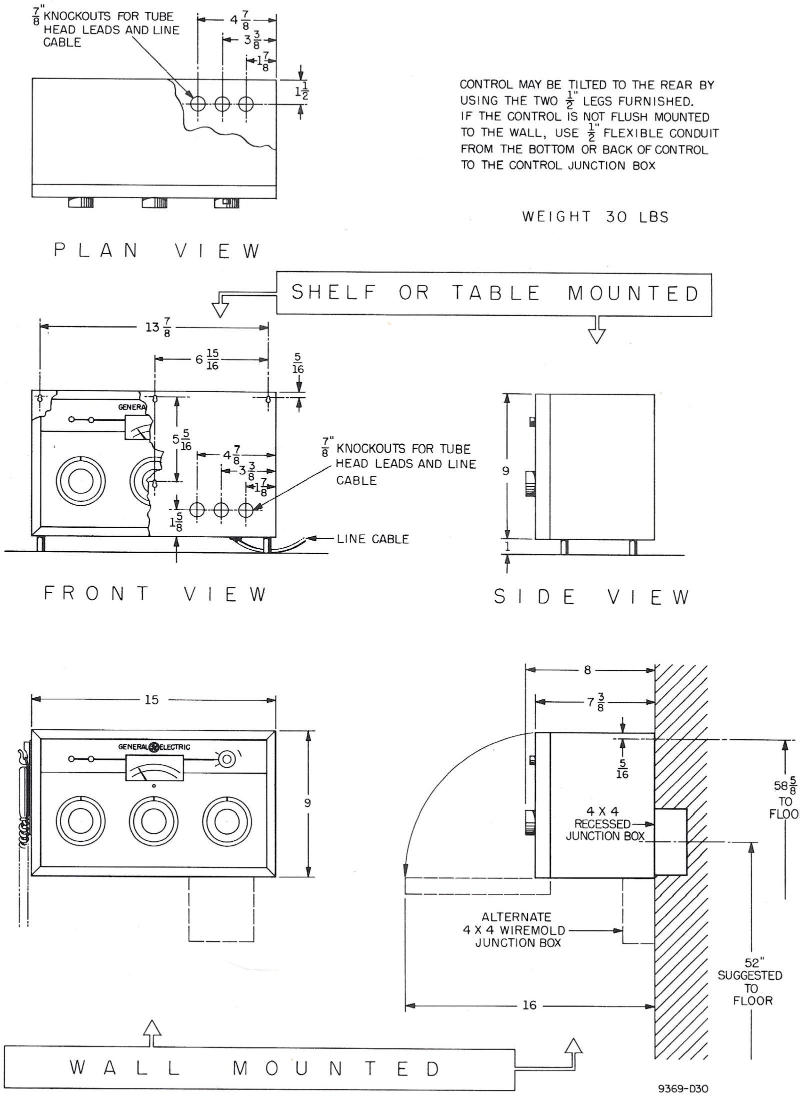

1" HOLES
ALTERNATE LOCATION
*
2 1/4"
2 1/4"
41"
31"
**
*
12"
1" HOLES
5 1/2"
5 1/2"
1 1/4"
5 1/2"
FLOOR CONTROL
7613-D20

ILLUSTRATION 4


7/8" KNOCKOUTS FOR TUBE HEAD LEADS AND LINE CABLE
4 7/8
3 3/8
1 7/8
1 1/2
PLAN VIEW
SHELF OR TABLE MOUNTED
13 7/8
6 15/16
5/16
GENERAL
5 5/16
4 7/8
3 3/8
1 7/8
1 5/8
7/8" KNOCKOUTS FOR TUBE HEAD LEADS AND LINE CABLE
LINE CABLE
9
1
FRONT VIEW
SIDE VIEW
15
GENERAL ELECTRIC
9
8
7 3/8
5/16
58 5/8 TO FLOOR
4 X 4 RECESSED JUNCTION BOX
ALTERNATE 4 X 4 WIREMOLD JUNCTION BOX
52" SUGGESTED TO FLOOR
16
WALL MOUNTED
9369-D30

CONTROL MAY BE TILTED TO THE REAR BY USING THE TWO 1/2" LEGS FURNISHED. IF THE CONTROL IS NOT FLUSH MOUNTED TO THE WALL, USE 1/2" FLEXIBLE CONDUIT FROM THE BOTTOM OR BACK OF CONTROL TO THE CONTROL JUNCTION BOX

WEIGHT 30 LBS

COMPACT CONTROL

ILLUSTRATION 5

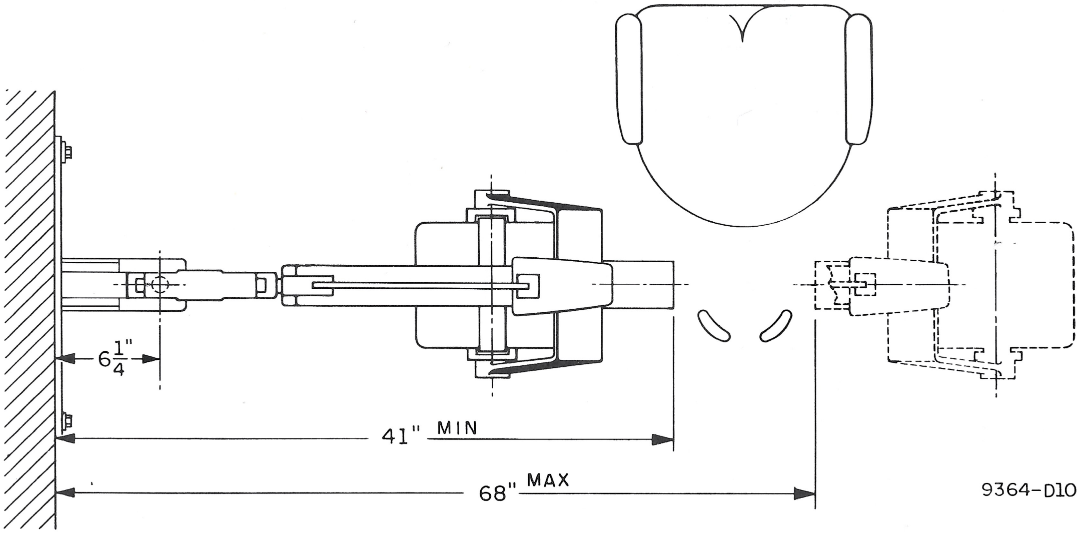
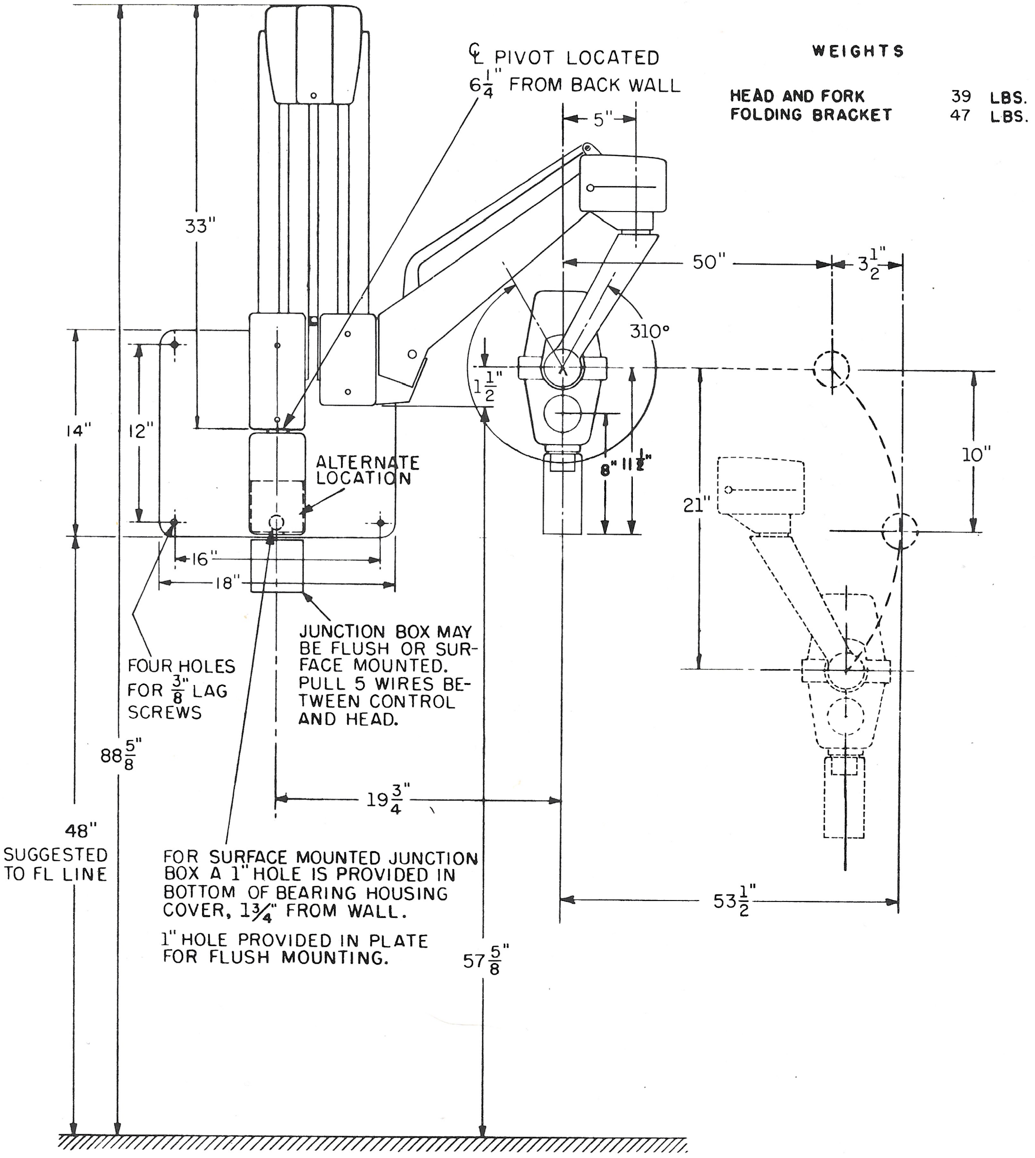

6¼"
41" MIN
68" MAX
9364-D10

ILLUSTRATION 6


℄ PIVOT LOCATED
6¼" FROM BACK WALL
5"
33"
50"
3½"
310°
1½"
14"
12"
10"
21"
8" 11½"
ALTERNATE LOCATION
16"
18"
88⅝"
19¾"
53½"
48" SUGGESTED TO FL LINE
57⅝"

WEIGHTS

HEAD AND FORK	39	LBS.
FOLDING BRACKET	47	LBS.

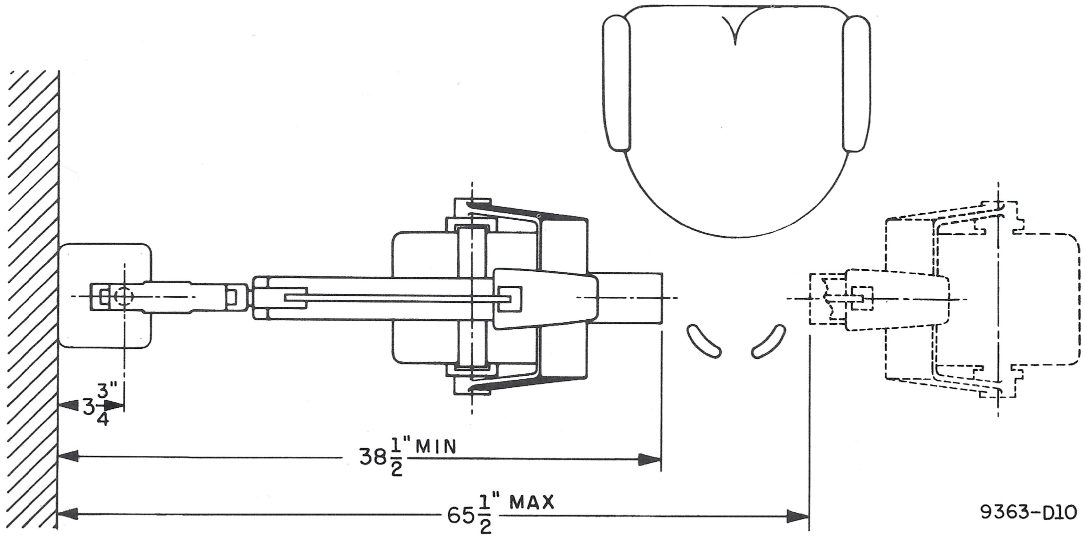
JUNCTION BOX MAY BE FLUSH OR SURFACE MOUNTED. PULL 5 WIRES BETWEEN CONTROL AND HEAD.

FOUR HOLES FOR $\frac{3}{8}$" LAG SCREWS

FOR SURFACE MOUNTED JUNCTION BOX A 1" HOLE IS PROVIDED IN BOTTOM OF BEARING HOUSING COVER, 1¾" FROM WALL.

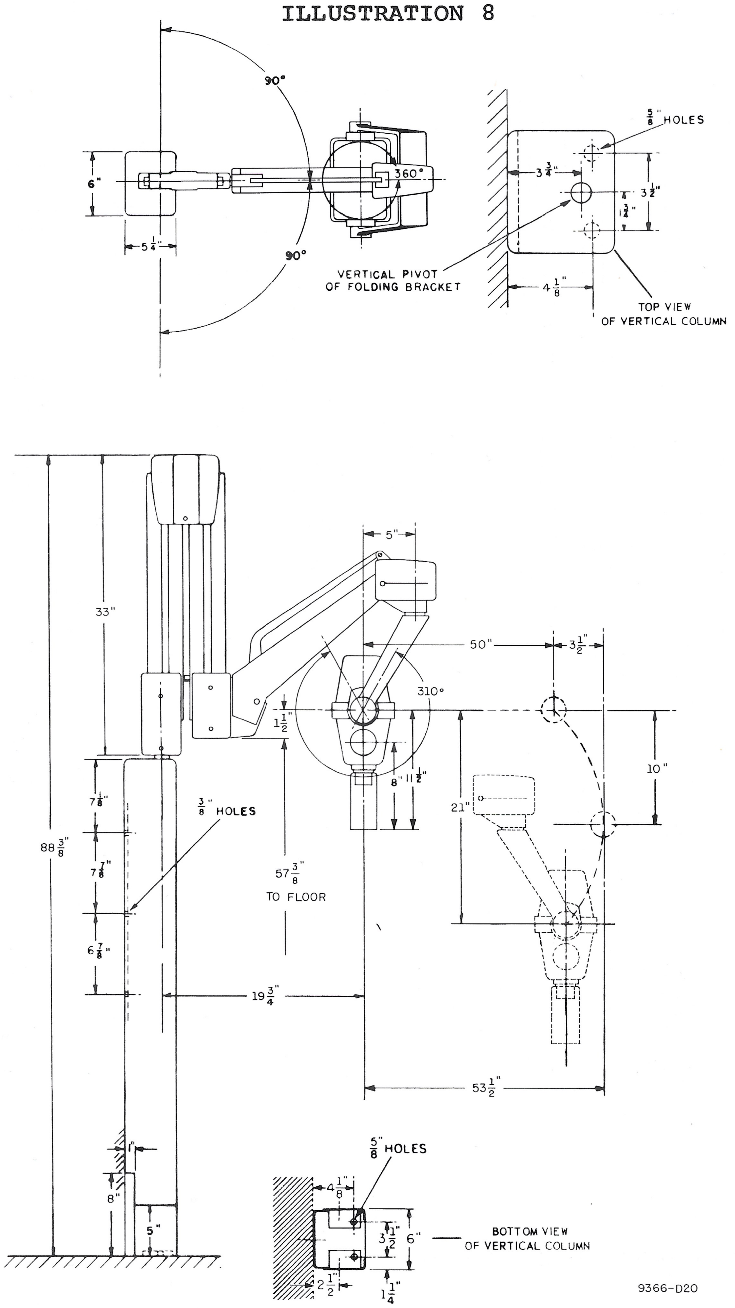
1" HOLE PROVIDED IN PLATE FOR FLUSH MOUNTING.

ILLUSTRATION 7



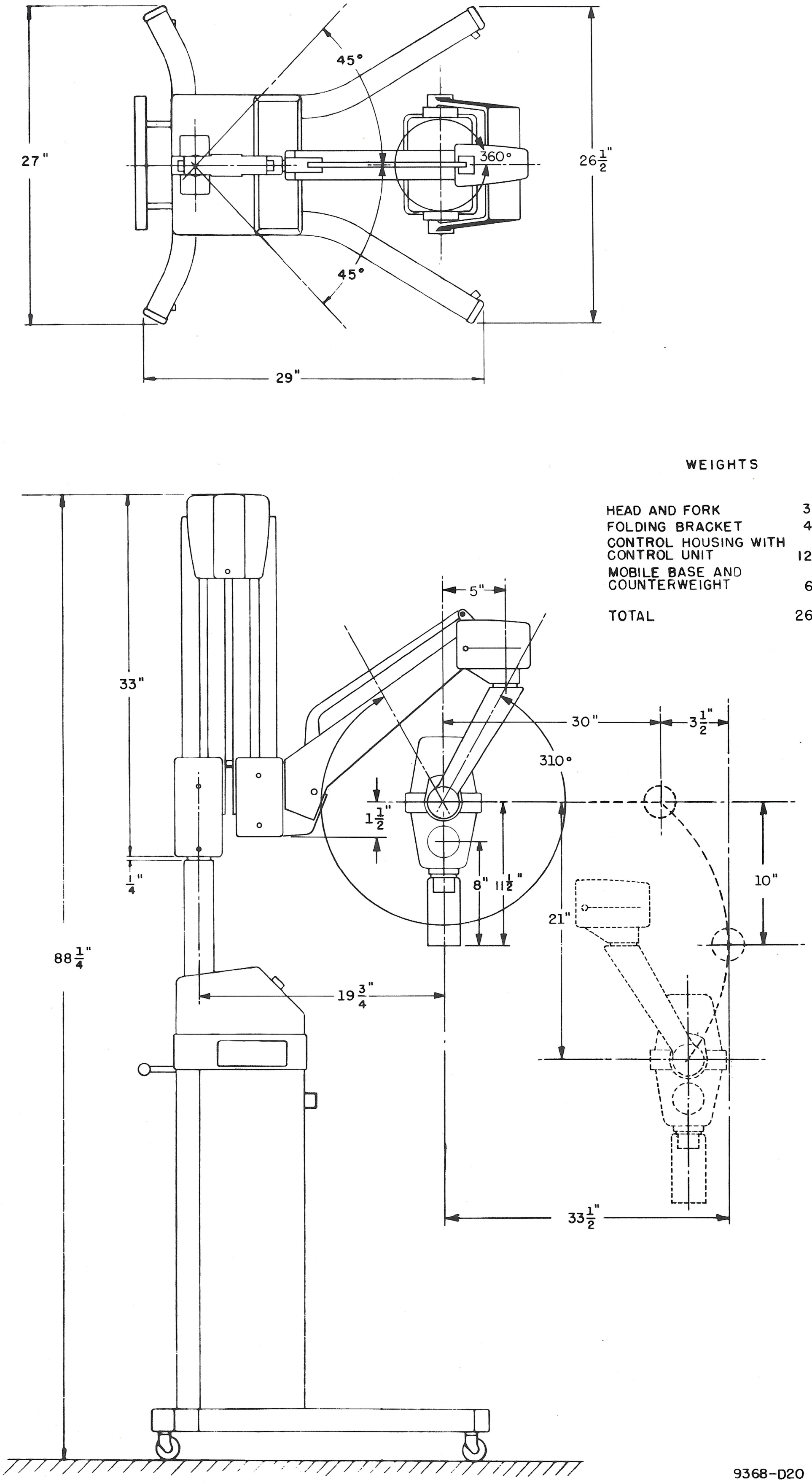
3 3/4"
38 1/2" MIN
65 1/2" MAX
9363-D10

ILLUSTRATION 8



90°
360°
90°
6"
5 1/4"
5/8" HOLES
3 3/4"
3 1/2"
1 3/4"
4 1/8"
VERTICAL PIVOT OF FOLDING BRACKET
TOP VIEW OF VERTICAL COLUMN
5"
33"
50"
3 1/2"
310°
1 1/2"
10"
8"
11 1/2"
21"
7 1/8"
3/8" HOLES
88 3/8"
7 7/8"
57 3/8" TO FLOOR
6 7/8"
19 3/4"
53 1/2"
1"
8"
5"
5/8" HOLES
4 1/8"
3 1/2"
6"
2 1/2"
1 1/4"
BOTTOM VIEW OF VERTICAL COLUMN
9366-D20

ILLUSTRATION 9


45°
45°
360°
27"
26½"
29"
5"
33"
30"
3½"
310°
1½"
¼"
8"
11½"
10"
21"
88¼"
19¾"
33½"
9368-D20

WEIGHTS

HEAD AND FORK	39 LBS.
FOLDING BRACKET	47 LBS.
CONTROL HOUSING WITH CONTROL UNIT	120 LBS.
MOBILE BASE AND COUNTERWEIGHT	60 LBS.
TOTAL	266 LBS.

ILLUSTRATION 10

DAMAGE IN TRANSPORTATION

31. THE GENERAL ELECTRIC COMPANY IS NOT RESPONSIBLE FOR GOODS LOST OR DAMAGED IN TRANSIT. The company's responsibility for safe delivery ceases when the transportation company accepts shipments in good order. All packages should be closely examined at time of delivery.

32. If damage is apparent, have notation of "bad order" made on freight or express bill. If damage is of a concealed nature, notify transportation agent not later than fifteen days after delivery, giving him an opportunity to make inspection and issue a "bad order report." A transportation company usually will not pay a claim for concealed damage if an inspection is not requested within fifteen days after delivery of the shipment.

UNPACKING

33. When unpacking, place the major components on soft padding to protect finished surfaces from marring or scratching.

34. Numerous claims of small parts shortage may be avoided if packing material, envelopes, packages, etc., are carefully examined. Do not discard the packing until the apparatus is assembled and all parts are accounted for.

TOOLS AND MATERIALS

35. Included in the list of tools and materials are those that are specifically required for mounting the unit to the wall and floor. These will be suitable for most cases. Since the type of floor and wall construction will vary, no single list can cover all tools and materials that will be needed. Different requirements should be anticipated and proper tools and materials provided.

TOOLS AND METERS

36. Spirit level, 12" long
    Tools for making mounting holes in the floor and wall:
        Portable electric drill with 1/2" chuck
        Twist drill, #2, for lag screw pivot holes
        Masonry or star drill, 1/2", for lead anchors
        Setting tool for 1/4" - 20 lead anchors
    Adjustable crescent wrench
    Open end wrench set, box wrench set or socket wrench set
    Allen head wrench, assorted set
    Screwdriver, 6" long
    Claw hammer, 12" long
    Pliers for installing strain relief bushing
    AC voltmeter, 0-150-300 volt scale
    DC milliammeter, 0-30 ma scale

MATERIALS

37. Floor Fasteners (Holes in Floor Base 3/8")

4 - Lag screws, 5/16" x 1-3/4" or equivalent 4 - Washers (appropriate size	Wooden floor
4 - Lead anchors, 1/4" - 20, Ackerman Johnson, Star Tampin or equivalent 4 - Hex head machine screws, 1/4" - 20 x 1" 4 - Washers (appropriate size)	Masonry floor

38. Wall Fasteners (Holes in Control Bracket and Vertical Column 3/8")

3 - Lag screws, 5/16" x 2-1/2" or equivalent 3 - Washers (appropriate size)	Plaster Wall (on wood studs)
3 - Toggle bolts (for hollow sections) 3 - Lead anchors, 1/4" - 20 Ackerman Johnson, Star Tampin or equivalent 3 - Hex head machine screws, 1/4" - 20 x 1" 3 - Washers (appropriate size)	Solid masonry wall (concrete or brick) Hollow masonry wall (concrete or clay tile)

3 - Machine screws or toggle bolts of length suitable to wall thickness 3 - Washers (appropriate size)	Plaster block wall

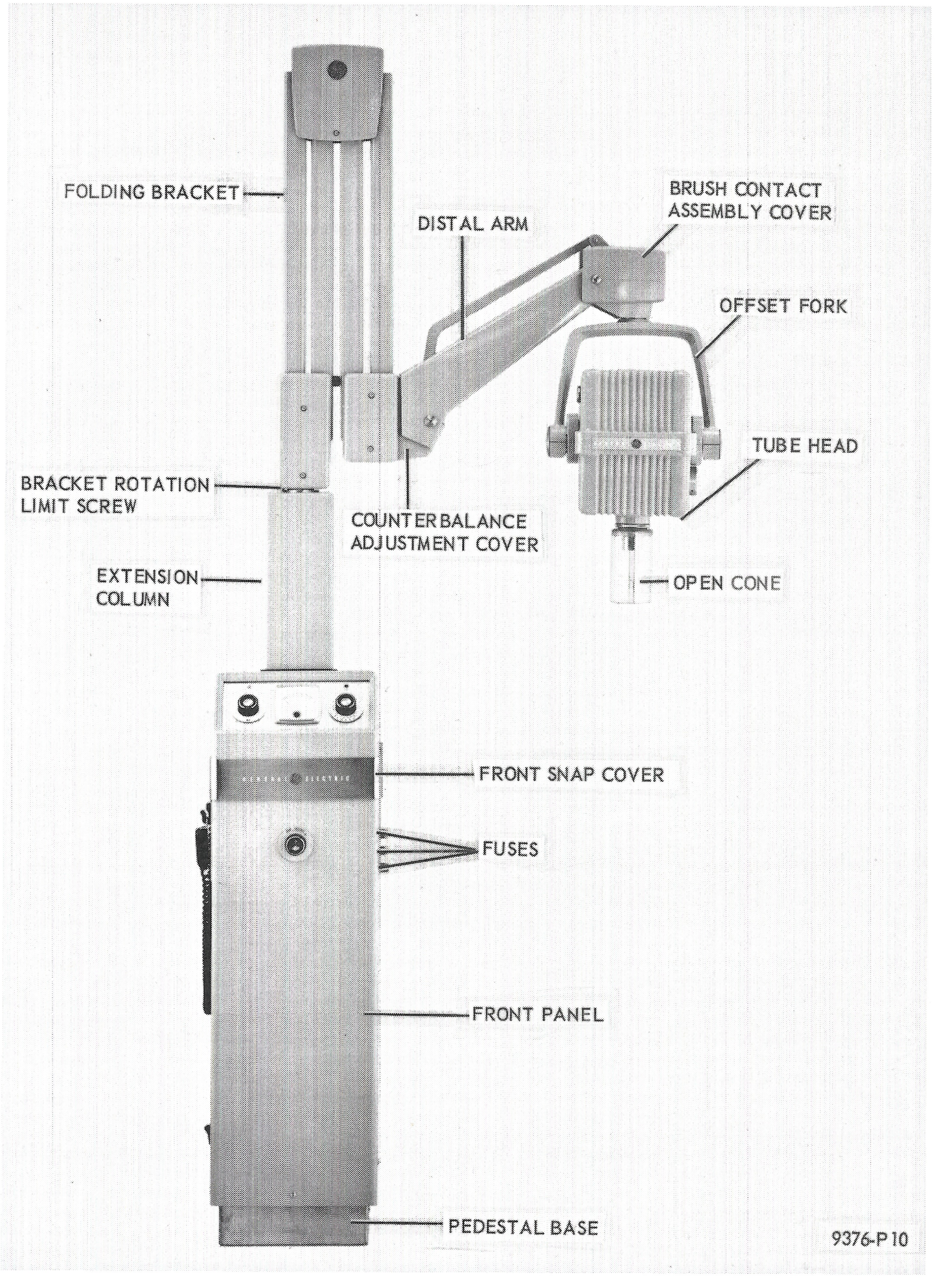
39. Wall Fasteners (Holes in Wall Plate 7/16")

4 - Lag screws, 3/8" x 2-1/2" or equivalent 4 - Washers (appropriate size) 4 - Nuts	Plaster wall (on wood studs)
4 - Toggle bolts (for hollow sections) 4 - Lead anchors, 1/4" - 20 Ackerman Johnson, Star Tampin or equivalent 4 - Hex head machine screws, 1/4" - 20 x 1" 4 - Washers (appropriate size)	Solid masonry wall (concrete or brick) Hollow masonry wall (concrete or clay tile)
4 - Machine screws or toggle bolts of length suitable to wall thickness 4 - Washers (appropriate size)	Plaster block wall

40. Wall Fasteners (Holes in Remote Compact Control .24")

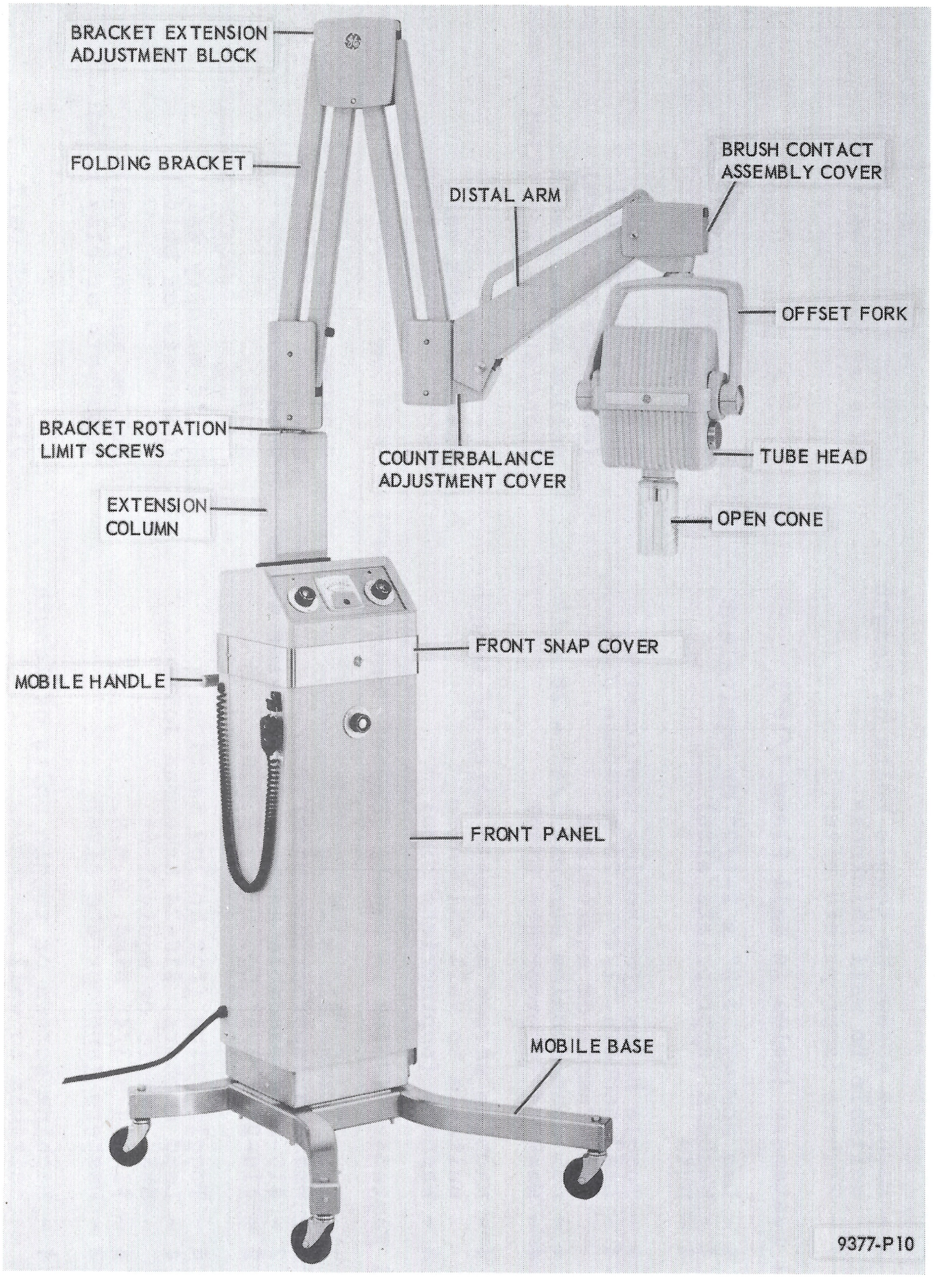
2 - Wood screws #10 x 2" lg. 2 - Washers (appropriate size) 2 - #10-24 expandable anchors for plaster walls 2 - #10-24 x 3/4" Lg. Bind. H.M.S.	Plaster wall on wood studs
4 - Toggle bolts (for hollow sections) 4 - Lead anchors, #10-24 Ackerman Johnson, Star Tampin or equivalent 4 - #10-24 x 3/4" Bind. H.M.S. 2 - Washers (appropriate size)	Solid masonry wall (concrete or brick) Hollow masonry wall (concrete or clay tile)
4 - Machine screws or toggle bolts of length suitable to wall thickness 2 - Washers (appropriate size)	Plaster block wall

Shims, 1" x 3" x 1/32" stock


FOLDING BRACKET
DISTAL ARM
BRUSH CONTACT ASSEMBLY COVER
OFFSET FORK
TUBE HEAD
BRACKET ROTATION LIMIT SCREW
COUNTERBALANCE ADJUSTMENT COVER
EXTENSION COLUMN
OPEN CONE
FRONT SNAP COVER
FUSES
FRONT PANEL
PEDESTAL BASE
9376-P10

GE-100, STATIONARY TYPE

ILLUSTRATION 11

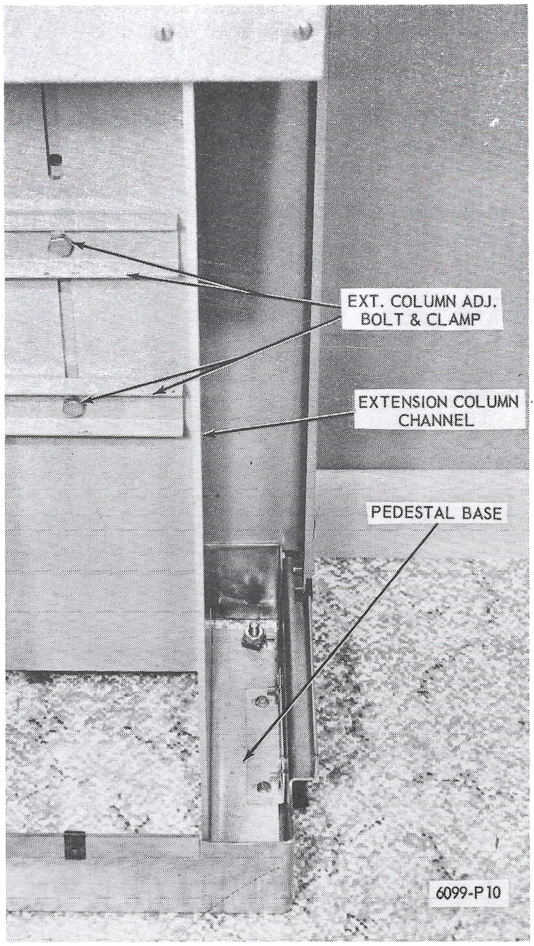

BRACKET EXTENSION ADJUSTMENT BLOCK
FOLDING BRACKET
BRUSH CONTACT ASSEMBLY COVER
DISTAL ARM
OFFSET FORK
BRACKET ROTATION LIMIT SCREWS
COUNTERBALANCE ADJUSTMENT COVER
TUBE HEAD
EXTENSION COLUMN
OPEN CONE
FRONT SNAP COVER
MOBILE HANDLE
FRONT PANEL
MOBILE BASE
9377-P10

GE-100, MOBILE TYPE

ILLUSTRATION 12

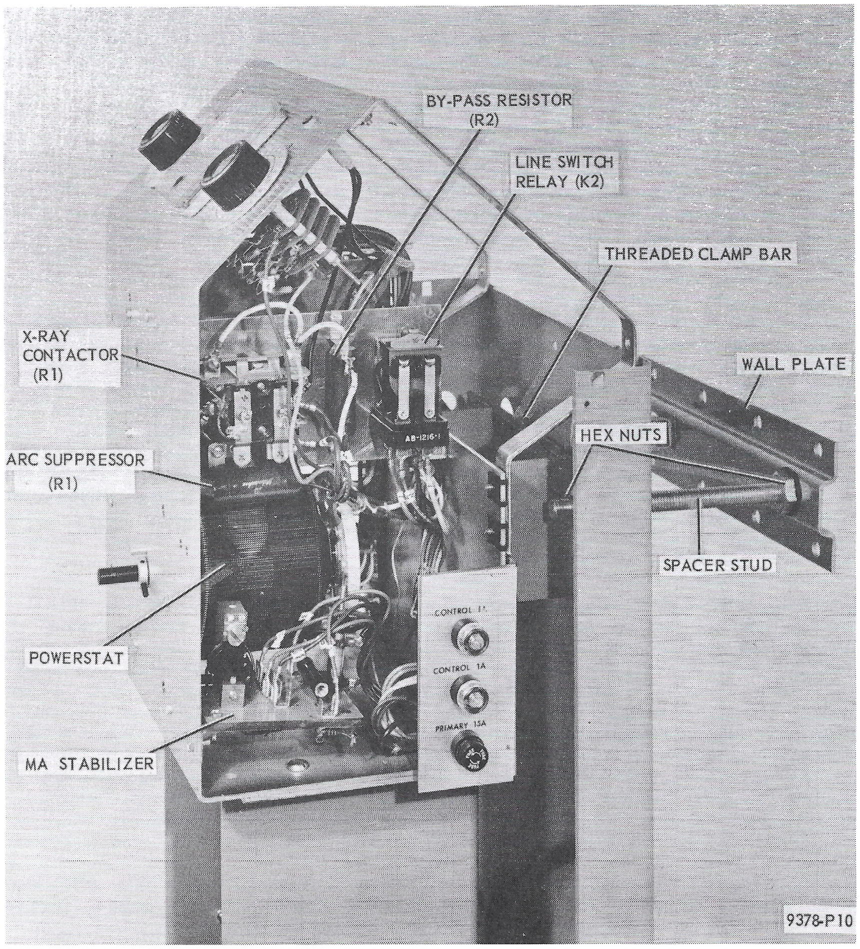
MECHANICAL ASSEMBLY

41. The control housing is shipped with the wall bracket and pedestal base assembled to it and is ready for stationary type of installation. For mobile type units the mobile base, complete with counterweight, is furnished separately.


EXT. COLUMN ADJ. BOLT & CLAMP
EXTENSION COLUMN CHANNEL
PEDESTAL BASE
6099-P10

LOWER CONTROL HOUSING

ILLUSTRATION 13


BY-PASS RESISTOR (R2)
LINE SWITCH RELAY (K2)
THREADED CLAMP BAR
WALL PLATE
X-RAY CONTACTOR (R1)
HEX NUTS
ARC SUPPRESSOR (R1)
SPACER STUD
AB-1216-1
CONTROL 1A
PRIMARY 15A
POWERSTAT
MA STABILIZER
9378-P10

WALL BRACKET

ILLUSTRATION 14

STATIONARY CONTROL

42. The front snap cover, Ill. 11, must be removed. The cover is held by 2 screws and snap pins. Use a screwdriver to pry loose taking care not to mar the finish.

43. Remove the Kvp Selector knob held by two set screws. Also remove the front panel held by seven screws.

44. Place the control housing in the mounting position determined under "Selection of Space". Push the control housing to bring the wall plate against the wall. See Ills. 2 and 3.

45. The wall bracket, Ill. 14, is adjustable. The range of adjustment from the center of the vertical pivot of the folding bracket to the wall is 5-1/4" to 7-1/2" (from the rear panel to the wall, 3-1/2" to 5-3/4"). Adjust the spacing at this time by loosening the hex nuts inside and outside the rear panel and next to the wall plate. Rotate the spacer studs until the desired spacing is achieved, and retighten the hex nuts.

Adjustment of Extension Column

46. The extension column, Ill. 11, has been adjusted at the factory to a certain dimension. On stationary units this adjustment will provide a height of 56-1/2" from the top of the extension column to the floor. This adjustment can be changed to meet individual

requirements from 51" to 61". The adjustment procedure is as follows:

To raise the extension column, remove the top adjustment bolt and clamp (see Ill. 13) and place in the extension column hole directly above (lower hole in top channel slot). This arrangement will allow raising the extension column a full 5" (from 56" to 61" measured from the top of the column to the floor).

Loosen the hex nuts on the wall bracket spacer studs inside the control (see Ill. 14). Loosen the lower adjustment bolt and raise the extension column to the desired height. Tighten the adjustment bolts and hex nuts to secure the column in position.

To lower the extension column remove the lower adjustment bolt and clamp (see Ill. 13) and place in the top extension column hole (top hole, top channel slot). This will allow lowering the extension column a full 5" (from 56" to 51" measured from the top of extension column to the floor). Loosen the hex nuts on the wall bracket spacer studs inside the control (see Ill. 14). Loosen the lower adjustment bolt and lower the extension column to the desired height. Tighten the adjustment bolts and hex nuts to secure the column in position.

47. Level the control housing in the side plane by placing the level on first one and then the other side of the extension column as shown in Ill. 11. If necessary, temporarily insert shims between the pedestal base and the floor to obtain proper leveling. Transfer the level to the front surface of the column and obtain true leveling in this plane. Recheck side leveling and re-shim if required.

48. With the column in true level in both planes, mark on the floor the hole centers for the four mounting holes of the pedestal base, and on the wall for the wall plate mounting holes. Move the control housing to the side so that floor and wall mounting holes can be drilled.

49. In case of plaster walls, selection of holes should be governed by location of wall studs or braces. Prepare to drill the holes. For plaster wall, use the #2 drill and drill into the wall studs or wall brace. The wall plate should be fastened when mounting the control housing with four 5/16" x 2-1/2" lag bolts.

50. For solid masonry construction, use the 1/2" star or masonry drill and drill the four holes to a depth of 1 inch. Place lead anchors in the holes and secure them to the wall by inserting the setting tool into the anchors and striking it a few times with a hammer. The wall plate should be fastened to the wall with four 1/4-20 x 1" hex head machine screws and washers.

51. For hollow masonry walls, use lead anchors in the cement portion between blocks, or in the partitions in the block itself. Use toggle bolts of sufficient size when the holes are drilled through the hollow portion of the block.

52. For plaster block walls, drill four holes completely through the wall. Since plaster block is brittle, a reinforcement plate is required. Fasten the wall plate after mounting the control housing with machine screws and nuts, using a metal plate on the rear side of the wall for reinforcement.

53. Drill the four floor mounting holes as required for the particular floor construction. Place the control housing in its mounting position. Place the level on the side of the extension column. If out of level, insert 1/32" shims between the pedestal base and the floor as needed. Transfer the level to the front surface of the channel. Insert shims if needed to level the channel in this plane. Bolt the pedestal base to the floor and fasten the wall bracket to the wall.

54. If the above operations have been carried out properly, the control housing will be level in both side and front planes. If minor re-adjustment is needed, loosen the hex nut inside and outside the control housing, on the wall bracket, move the studs as needed and again tighten the hex nuts.

REMOTE FLOOR CONTROL

55. The front snap cover, Ill. 15, must be removed. The cover is held by 2 screws and snap pins. Use a screwdriver to pry loose taking care not to mar the finish.

56. Remove the Kvp Selector knob held by two set screws. Also remove the front panel held by seven screws.

57. Place the control housing in the mounting position determined under "Selection of Space". See Ill. 4.

58. With the unit in place, mark on the floor the hole centers for the four mounting holes of the pedestal base. Move the control housing to the side so that floor mounting holes can be drilled. Drill the four floor mounting holes as required for the particular floor construction involved. Place the control housing in its mounting position. Bolt the pedestal to the floor.

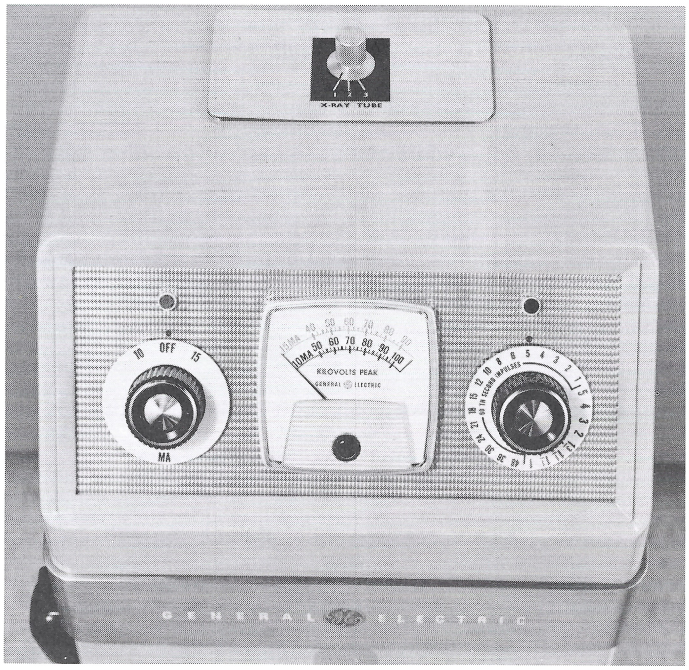


ILLUSTRATION 15

Optional Tube Head Selector Switch

59. Remove the extension column cover on top of the unit. Replace the cover with the Selector Switch (Ill. 15). It will be necessary to remove the knob, hex nut, and switch plate before mounting the switch and bracket to the control. Note the position of the knob before removing so that it can be remounted in the same position.

60. Connect the leads in the first branch of the harness (nearest switch) to terminal strips TS1 and TS2 in the control according to the lead markings. Mount the two furnished terminal strips to either side of the control. See Ill. 23. Connect the remaining leads to the two furnished terminal strips according to the lead markings.

REMOTE COMPACT CONTROL

61. Remove the two screws shown in Ill. 16 to gain access to the control. If the control is to be shelf or table mounted, assemble the four 1" legs to the bottom of the control. See Ill. 5. Note that the control may be titled by using two 1/2" legs. If the furnished line cord is to be used, the control must be firmly anchored to the shelf or table. Thread a #8 x 2" lg. woodscrew through each of the four legs and into the table or shelf.

62. If the control is to be wall mounted locate the control so that the control junction box is directly behind or beneath the knockouts provided in the control. See Ill. 5.

63. In the case of plaster walls the control should be located so that the two center key slots are located over a wall stud. Use two #10 woodscrews 2" lg. and appropriate washers for mounting the control the wall stud. Two expandable #10-24 anchors may be imbedded in the plaster in line with the other two key slots. Use two #10-24 x 3/4" lg. Bind. H.M.S. for fastening the control to the expandable anchors.

64. For solid masonry construction, use the 3/8" star or masonry drill and drill the four holes to a depth of 3/4". Place lead anchors in the

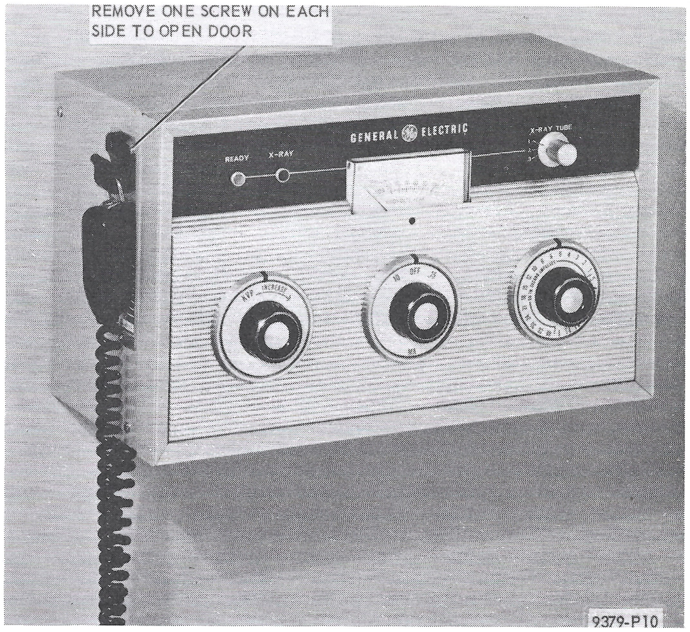

REMOVE ONE SCREW ON EACH SIDE TO OPEN DOOR

ILLUSTRATION 16

holes and secure them to the wall by inserting the setting tool into the anchors and striking it a few times with a hammer. The control should be fastened to the wall with four #10-24 x 3/4" Bind. head machine screws and two washers.

65. For hollow masonry walls, use lead anchors in the cement portion between blocks, or in the partitions in the block itself. Use toggle bolts of sufficient size when the holes are drilled through the hollow portion of the block.

66. For plaster block walls, drill four holes completely through the wall. Since plaster block is brittle, a reinforcement plate is required. Fasten the wall plate after mounting the control housing with machine screws and nuts, using a metal plate on the rear side of the wall for reinforcement.

MOBILE CONTROL

67. Place the mobile base on the floor and place the counterweight, on the mobile base.

68. The front snap cover, Ill. 12 must be removed. The cover is held by two screws and snap pins. Use a screwdriver to pry loose taking care not to mar the finish.

69. Remove the Kvp Selector knob held by two set screws. Also remove the front panel held by seven screws.

70. Lift the control housing, set it on the mobile base with the control panel facing as shown in Ill. 12 and fasten with the four 5/16-18 x 3-1/2 hex hms, eight washers and four hex nuts supplied with the mobile base and the control housing.

71. Remove the wall bracket by unscrewing the two large hex nuts from inside the control housing. Unscrew the two large hex nuts which still remain on the wall bracket. Save the hex nuts. Discard the wall bracket. Replace the threaded clamp bar in the control with the clamp bar furnished with the mobile base. See Ill. 14.

72. Screw one large hex nut on each support bar of the push pull handle. Insert the support bars in the holes in the rear of the control housing and fasten them securely from the inside with the two remaining hex nuts.

Adjustment of Extension Column

73. Procedure for adjustment of the extension column on the mobile unit is the same as on the stationary unit and is covered previously under the same heading.

74. On mobile units received from the factory the extension column is adjusted to provide a height of 62-1/2" from the top of the extension column to the floor. This adjustment must be changed to 55" in order to provide stability of the unit.

Folding Bracket

75. Before installing the folding bracket, it will be necessary to limit its rotation about the vertical axis to obtain the required stability. To limit the bracket rotation, remove the bracket rotation limit screws, from the front holes in the top of the extension column and screw them into the rear holes.

76. Actual installation of the bracket is the same for all units. Refer to "Installing Bracket."

Limiting Bracket Extension

77. The folding bracket extension limit has been adjusted at the factory for stationary type units. For mobile units, this limit must be restricted to obtain the necessary stability. Remove the two upper bracket trim covers covering the four screws holding the extension adjustment block. Remove the four screws and turn the adjustment block upside down. Replace the four mounting screws. Adjust the bracket extension limit screw so that the maximum bracket extension is 44-3/4" between the center of the vertical pivot and the center of the fork swivel. See Ill. 10.

MOUNTING VERTICAL COLUMN FOR REMOTE TUBE HEAD

78. Remove the cover from the vertical column by removing the four mounting screws.

79. Place the vertical column flush against the wall in the selected location. See Ills. 8 and 9. See if the cutout in the rear of the column fits over the molding. If the base board is too high or in any other way interferes with the column, remove or notch out the base board for correct fit.

80. A knock-out is provided on each side of the vertical column. Select and remove the knock-out for control cable on the side of the column nearest the control supplying the unit. To remove the knock-out, use a hammer and a drift pin. Be careful not the mar the finish.

81. With the vertical column in place, mark the location of the two 5/8" floor mounting holes on the floor. Drill two holes. For a wooden floor, use the #2 twist drill. For a masonry or terrazzo floor, use the 1/2" star or masonry drill and drill the holes to a depth of 1". Place the lead anchors into the holes and secure them to the floor, by inserting the setting tool in the anchor and striking tool with a hammer. Temporarily fasten the vertical column to the floor to permit horizontal alignment and marking of column mounting holes.

82. Align column horizontally using the level on the top bearing plate. Be sure to level this plate both ways (Front to Back and Side to Side). Temporarily insert floor shims (not provided) to position column.

83. Mark the location of the three wall mounting holes on the wall. Remove the housing by unscrewing the floor mounting screws. Drill the holes in the wall. Use the #2 drill if the control housing is to be mounted on the wall studs or wall braces. If the wall is of solid masonry construction, use the 1/2" star or masonry drill and drill the holes to a depth of 1". Place the lead anchors into the holes and secure them to the wall by inserting the setting tool in the anchor and striking the tool with a hammer. For plaster block walls use a twist drill and drill holes of a size to admit the toggle bolts or machine screws.

84. Fasten the vertical column with floor and wall mounting screws. Place a washer between each screw head and housing. Recheck the alignment. Use thin metal shims under the base as previously described to obtain correct alignment. When the column is in position tighten the screws.

MOUNTING WALL PLATE FOR REMOTE TUBE HEAD

85. The mounting holes for the Wall Plate have a 16" spread. This facilitates mounting directly to wall studs. On plaster walls the location of the Plate will be somewhat governed by the location of the wall studs. If the studs are not on 16" centers, additional tie-in to the studs must be made to accommodate the 16" mounting holes. See Ills. 6 and 7. Four 3/8 x 3" hanger bolts, washers and nuts are furnished for mounting the plate.

86. On hollow or solid masonry construction suitable lead anchors should be used for mounting the plate. These should be designed to withstand a pull force of 100 lb. per bolt.

87. In general, the height of the Wall Plate should be such that the distance from the bottom edge of the Plate is 48" from the floor. This distance, however, may be changed to suit individual requirements.

88. Align the plate horizontally, using a level on the top bearing plate.

89. Spot the mounting holes and mount the hanger bolts.

90. Attach the Wall Plate to the wall. If the junction box is flush mounted pull the five leads through the 1" hole in the Wall Plate.

91. Recheck to make sure the top bearing is level in both directions (front to back and side to side). Shim if necessary.

INSTALLING BRACKET

92. A rubber band is placed on the bracket pivot stud to hold the bracket bearing and bearing spacer in place during shipment. NOTE: Remove the rubber band before attempting to assemble the bracket to the extension column. The bearing bracket and bracket pivot stud are lubricated at the factory. Check before assembly. If lubrication is required use EL-2000 lubricant. Lubricate about 1" of the bottom of the pivot post before assembly. Place the bracket bearing in the hole on top of the extension column so that the inner bearing race will be toward the top. Place the bearing spacer in the bracket bearing, Ill. 17.

93. Lay the folding bracket on a convenient working surface. Thread the bracket cables through the bearing spacer and the sleeve bearing in the housing. Pull the cables through as far as possible. Lift the bracket up and hold it so that its pivot is directly above the bearing spacer. Slowly insert the bracket pivot into the bearing while pulling on the cables. The bracket pivot should also pass through the sleeve bearing hole in the housing.

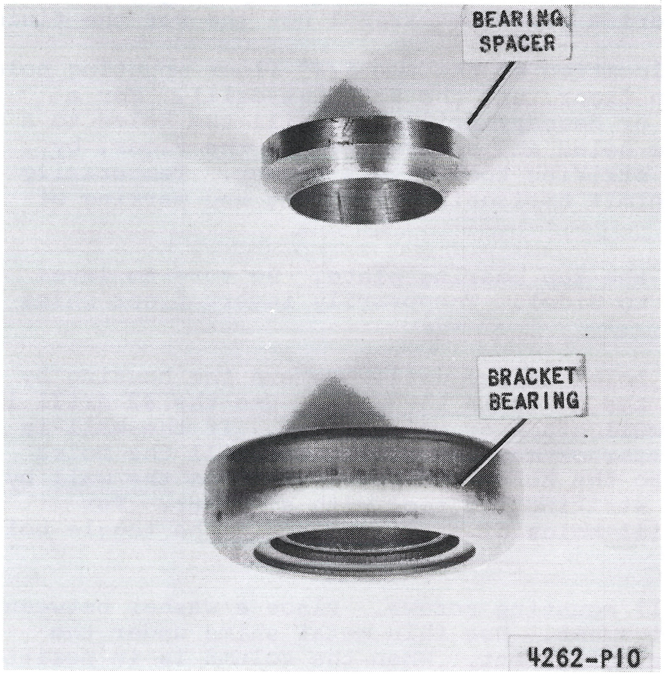


ILLUSTRATION 17

94. Two bracket rotation limit screws limit the rotation of the folding bracket to 180° to minimize the possibility of the tube head hitting the wall, provided the tube head is placed in the "at rest" position, namely its long axis parallel to the wall and the cone pointing downward. The bracket rotation limit screws should be in the two front holes of the extension column.

95. There are spacers under the heads of the bracket rotation limit screws making it possible to adjust the height of the screws to prevent rubbing on the bottom of the folding bracket. If rubbing occurs, remove the spacers, as required. If necessary, remove the folding bracket trim covers to get at the rotation limit screws.

TUBE HEAD

96. Remove the brush contact assembly cover, Ill. 20, and remove the assembly by taking out the two screws at the top and bottom of the brush contact assembly, Ill. 18. Remove the two head mounting pins, Ill. 19, by unscrewing them as far as possible and pulling them out. Apply EL-2000 lubricant to the upper and lower bearing surfaces of the fork pivot shaft. Make sure the commutator segments and brushes are clean and free from grease.

97. Lift the tube head as shown in Ill. 19. When the commutator is completely in, push in the head mounting pins to support the tube head. Screw them in with a screwdriver. Check the spacing between the end of each spring and the mounting board of the brush contact assembly. It should not be less than 3/8". Replace the brush contact assembly and see that the brushes fit properly. Replace the brush contact assembly cover.

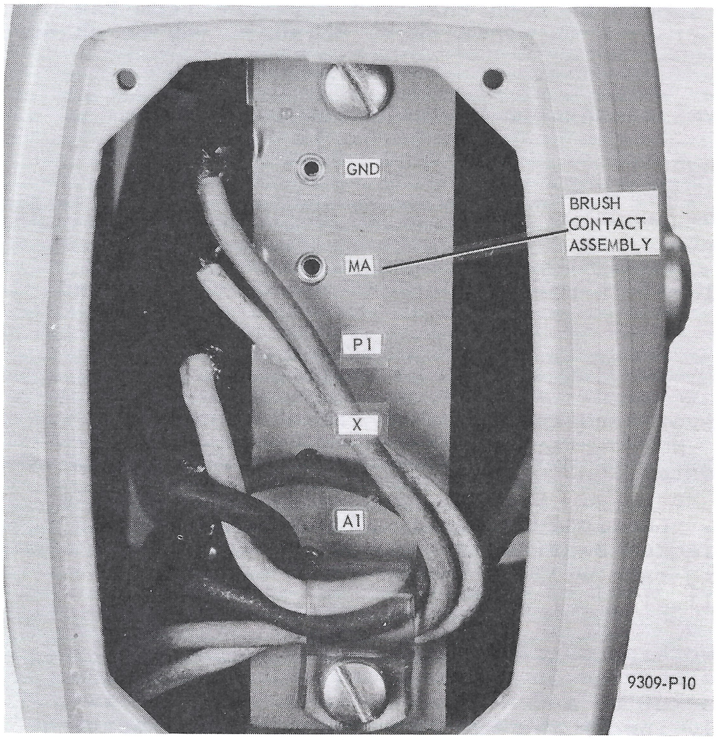


ILLUSTRATION 18

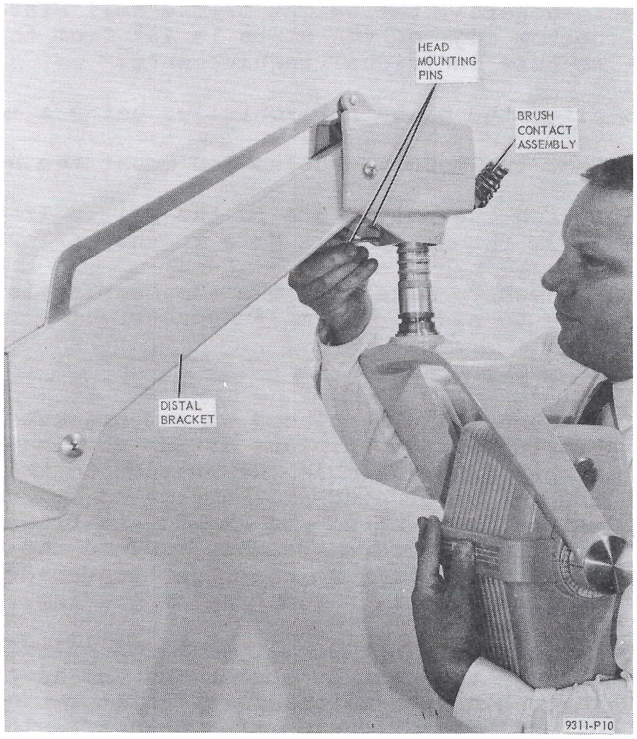


ILLUSTRATION 19

CONE

98. Place the locking ring on the cone. Thread it in as far as it will go. Screw the cone and lock ring assembly into the port opening as far as it will go without forcing. Back the cone off slightly until two of the indicating lines are in the horizontal plane and two in the vertical plane when the tube head is horizontal (0 deg. on indicator). Finally, lock the cone in place by tightening the lock ring against the head.

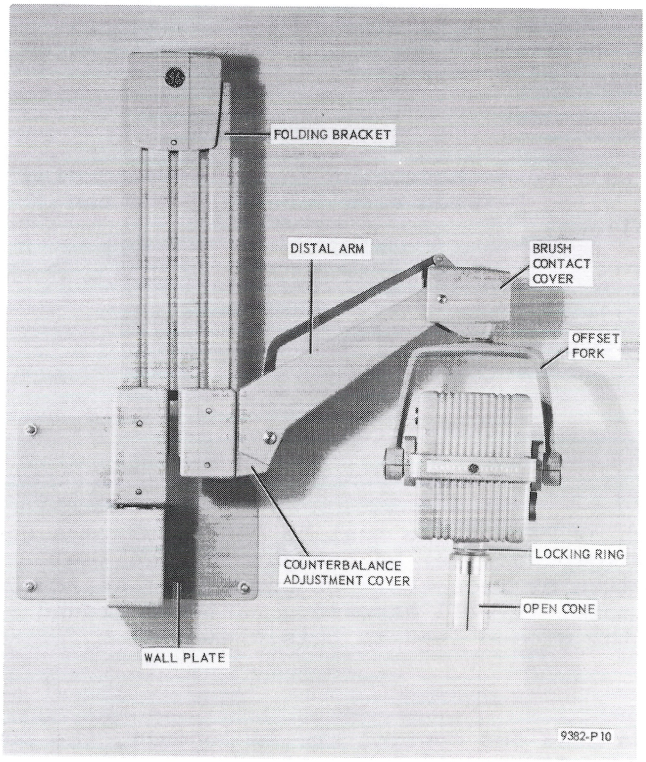

FOLDING BRACKET
DISTAL ARM
BRUSH CONTACT COVER
OFFSET FORK
LOCKING RING
OPEN CONE
COUNTERBALANCE ADJUSTMENT COVER
WALL PLATE
9382-P10

ILLUSTRATION 20

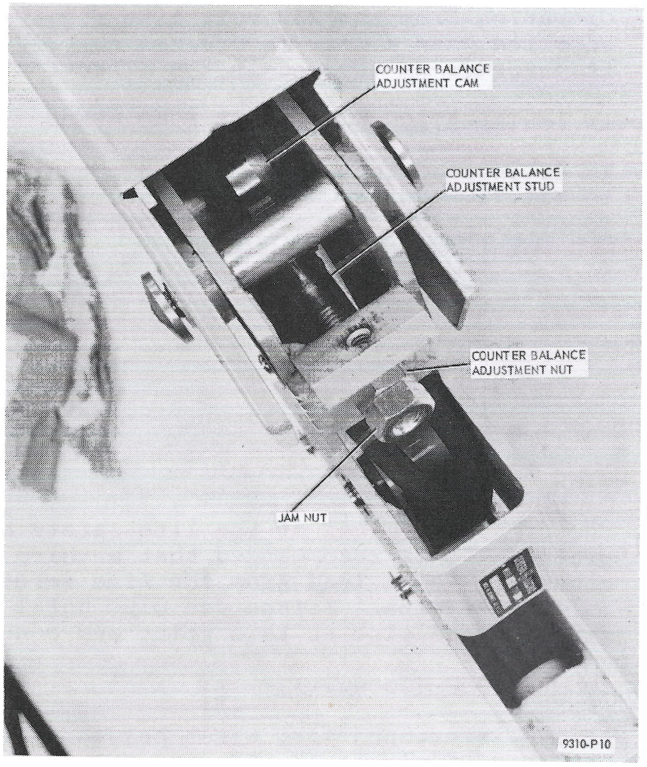

COUNTER BALANCE ADJUSTMENT CAM
COUNTER BALANCE ADJUSTMENT STUD
COUNTER BALANCE ADJUSTMENT NUT
JAM NUT
9310-P10

ILLUSTRATION 21

MECHANICAL TEST AND ADJUSTMENT

99. Check that the bracket stays in any position in which it is placed. Do this by rotating the bracket first to one side, then to the other side and finally straight out. If it tends to swing away, recheck the leveling of the control housing, vertical column, or wall plate, and shim if necessary.

100. Check the distal bracket counterbalance. It has been adjusted at the factory, and the effort to move the tube head either up or down should be approximately the same.

101. If the distal bracket counterbalance is not satisfactory, adjust as follows:

    a. Remove the two lower trim covers on the extension arm which cover the mounting screws for the counterbalance adjustment cover, Ill. 20.

    b. Remove the counterbalance adjustment cover, Ill. 20.

    c. The large stud and hex nuts are for adjusting distal bracket counterbalance. See Ill. 21. Loosen the jam nut while holding the adjustment nut from turning. If the tube head is harder to push up than to pull down, or creeps downward turn the adjustment nut clockwise. If the tube head is harder to pull down than to push up, or creeps upward turn the adjustment nut counterclockwise. Make sure that the spring chain is riding over its cam. Tighten the jam nut on the adjustment nut after completing the adjustment.

    d. Replace all covers.

102. Check the tube head rotation in the fork. If the tube head is too tight or too loose, adjust as follows:

a. Rotate the tube head so that the cone is pointing up. The pivot adjustment screws are now accessible thru the slots in the bottom of the tube head pivot center of the fork.

b. Adjust the two set screws so that the head will rotate with minimum effort, yet stay in any desired position without turning. Loosen the screws slightly if the tube head turns hard, or tighten them slightly if it turns too easily.

ELECTRICAL CONNECTIONS

103. These units can be operated from an ac supply of either 115 volts or 230 volts. Operation from the 230 volt line requires the use of an autotransformer, which is supplied when a unit is ordered for 230 volt operation. Mount and connect the autotransformer as covered in the direction supplied with this item.

CONDUIT INSTALLATION FOR REMOTE TUBE HEADS

104. It is assumed that the required conduit and wall boxes have been installed according to Ill. 1. "Ring Out" the 5 interconnecting wires between each tube head and the control. Label all leads on both ends as follows:

HEAD #1	HEAD #2	HEAD #3
P1-1	P1-2	P1-3
X-1	X-2	X-3
MA-1	MA-2	MA-3
A1	A1	A1
GND	GND	GND

GROUNDING

105. The ground terminal of the line safety switch or receptacle must be connected to a good ground. It is recommended that a third wire (ground wire) be brought through the conduit. Run a lead from the line safety switch or receptacle ground to the nearest cold water pipe. Scrape the pipe until the metal is well exposed. Fasten a ground clamp to the pipe at this point and connect the ground lead to this clamp.

LINE CONNECTIONS (Conduit)

106. If the interconnecting wires between the tube head and control are in conduit, the power leads to terminals L1, L2, and GND must also be in conduit and a 15 amp fused line safety switch or circuit breaker must be provided. Connect the leads from the line safety switch or circuit breaker to terminals TS1-L1, L2, and GND in the control. If the Optional Tube Head Selector Switch has been added to the Remote Floor Control, connect the power leads to terminals TS3-L1, L2, and GND. See Ills. 22 and 23.

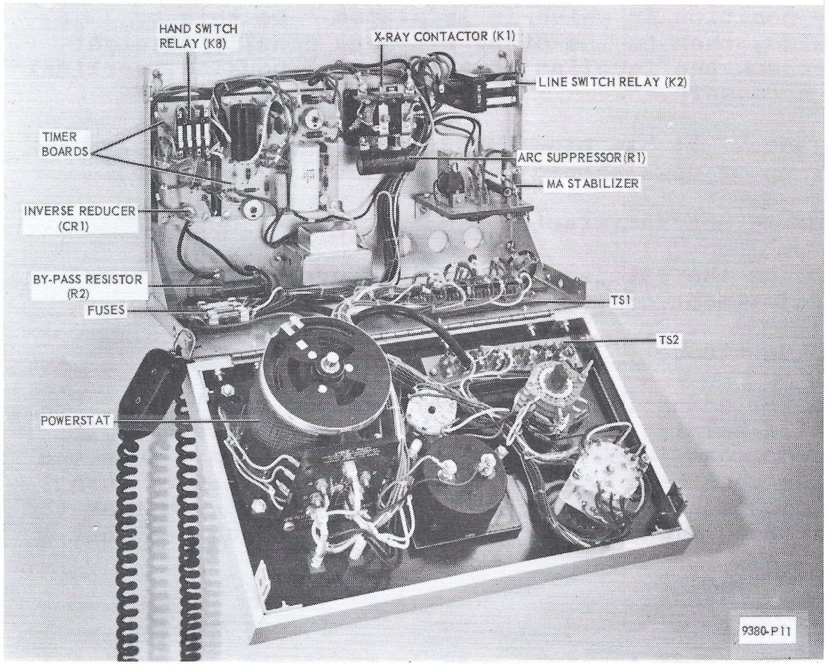


ILLUSTRATION 22

LINE CONNECTIONS (No Conduit)

107. If the interconnecting tubehead cable is connected directly to the control, through the bushings provided, the line cord and a three prong receptacle may be used. Connect the line cord to terminals TS1-L1, L2, and GND in the Control. See Ills. 22 and 23.

HAND SWITCH CONNECTIONS

108. Hand Switch connections for all models except the Remote Compact Control are made at the factory. Connect the Hand Switch leads to terminals TS2-2 and 3 in the Compact Control. See Ill. 22. This connection is not switched by the tubehead selector.

HEAD CABLE CONNECTIONS AT THE CONTROL

Stationary and Mobile Controls

109. Loop the tube head cable emerging from the bottom of the channel toward the rear side of the control chassis. Connect the five wires, labeled X, A1, P1, MA and GND of the tube head cable to the corresponding terminals on the terminal strip (TS1) on the left side of the control chassis as shown on Ill. 23.

Remote Floor Control

Single Tube Head

110. Connect the five wires, labeled X, A1, P1, MA and GND from the tube head to the corresponding terminals on the terminal strip (TS1) on the left side of the control chassis as shown on Ill. 23.

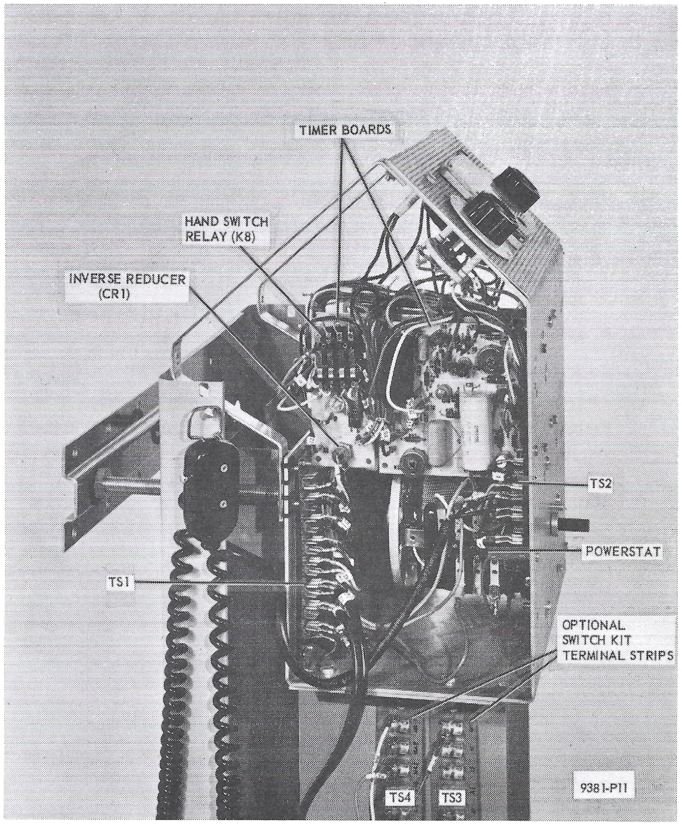


ILLUSTRATION 23

Multiple Tube Heads

111. Lug and connect the five stranded wires from each head to terminal strips TS3 and TS4 in the control according to their lead markings. See Ill. 23 and "Conduit Installation For Remote Tube Head".

Remote Compact Control

112. Lug and connect the five stranded wires from each head to terminal strips TS1 and TS2 according to their lead markings. See Ill. 22 and "Conduit Installation For Remote Tube Heads".

HEAD CABLE CONNECTIONS AT BRACKET

113. Lug and connect the head cable to a terminal strip in the junction box or if a terminal strip is not available connect the 5 interconnecting wires directly to the head cable. When the interconnecting wires are spliced directly to the head cable, the connections should be soldered to assure good electrical contact and the individual lead should be taped with electrical insulating tape.

ELECTRICAL TEST AND ADJUSTMENT

114. The purpose of the electrical tests is to make sure that the unit is operating satisfactorily. Since this requires making X-ray exposures, turn the tube head so that no direct radiation is received by anyone present at the installation. Do not attempt to make a 4, or 5 second exposure at 90 kvp and 15 ma. Serious damage to the X-ray tube may result.

LINE VOLTAGE ADJUSTMENT

115. This X-ray unit can be adjusted for operation at any voltage within the 100 to 130 volt range. The adjustment is made by reconnecting the lead marked 5X (connected to terminal 5 at the factory) to the appropriate terminal on the Powerstat.

116. To determine the proper connection of lead 5X, measure the line voltage with an ac voltmeter at terminals L1 and L2 of the terminal strip (TS1). The proper terminal connection for lead 5X, depending on line voltage, is given below:

Line Voltage	Connect Lead 5X to Powerstat Terminal
100 - 105	2
106 - 111	4
112 - 120	5
121 - 130	6

VOLTAGE REGULATION ADJUSTMENT

117. The Kvp Meter is connected to Powerstat terminals 3 and 7. Terminal 7 is connected to a slider contact on the powerstat which must be properly set to obtain correct readings on the Kvp Meter. Correct calibration of the meter depends on the voltage regulation of the supply source.

118. Use extreme care when calibrating the Kvp Meter as the control must be energized when making the adjustments. To calibrate the Kvp Meter:

   a. Connect a test voltmeter (0 - 150 v ac scale) across powerstat terminals 1 and 3. Turn the line switch to the 15 ma position and adjust the Kvp Control to 103 volts on the test voltmeter.

   b. Loosen the screw holding the slider contact (connected to terminal 7) on the powerstat and set the contact so that the Kvp Meter reads 80 kvp on the 15 ma scale.

   c. With the line switch set to 15 ma make a trial 3 second exposure and note the reading on the Kvp Meter during the exposure.

   d. After the trial exposure is completed set the slider contact on the powerstat so that the Kvp Meter reads the same kvp value noted during the exposure. Do not move the KVP selector knob. Tighten the screw holding the slider contact after completing the adjustment.

STABILIZER CHECK AND ADJUSTMENT

119. The stabilizer check consists essentially of connecting a dc milliammeter, 0-20 scale, in series with the midpoint of the secondary of the high voltage transformer, making an exposure, and reading the meter. It should read 10 ± 1/2 ma or 15 ± 1/2 ma depending on the position of the MA Selector.

120. Refer to "Stabilizer Check" under "Stabilizer" in the Maintenance section for details in making this check. If the current is outside the above limits, readjust the stabilizer as covered under "Stabilizer Adjustment" in the same section.

TIMER CHECK

121. The purpose of this check is to determine if the timer starts and stops the exposure and the accuracy of timing.

122. Set the Time Selector to 3 seconds. Depress the Hand Switch button. The start of the exposure will be evidenced by the clicking noise associated with closing of the X-ray contactor or by the exposure light being energized. The end of the exposure will be signaled by the clicking noise due to opening of the X-ray contactor or by the exposure light being extinguished. Make another exposure and read the time between these events with a regular watch or a stop watch. The time interval should be 3 ± .06 seconds as an average for three consecutive exposures. Exposures at other settings of the Time Selector can be assumed to be correct.

123. If the time of the exposures is outside the above limits, the time calibration potentiometer should be readjusted as covered under "Time Adjustment" in the Maintenance Section.

COMPLETION OF INSTALLATION

124. Replace all panels and trim covers. Make sure that the trim covers on the bracket are properly aligned and that there are adequate clearances in all positions. Wipe the unit with a clean dry cloth. Do not use any solvents which will dull or mar the paint finish. Warm soapy water may be used if necessary.

MAINTENANCE

125. The information contained in this section is intended to aid in locating difficulties and correcting them. Study this information and refer to it as necessary to save time and effort. Occasionally it will be necessary to obtain replacement parts or return the major components or parts to the repair depots of the General Electric Company, X-Ray Department. All parts are listed in Renewal Parts. Most components of the electronic timer are standard parts which can be purchased in any radio supply house provided that they are of comparable quality.

CAUTION

126. Before servicing any electrical components, be sure to disconnect the unit from the line.

127. When making test X-ray exposures, turn the tube head so that no direct radiation is received by anyone present at the installation.

LINE SWITCH

128. Failure of the Pilot Light to light and the Kvp Meter to read is an indication that power is not being supplied to the unit. Check that the line cord is plugged into the electrical outlet. Check that relay (K2) pulls in when the line switch (S2) is turned to the 10 or 15 ma position. If the relay pulls in the line switch is operating properly. If the relay does not pull in, check the contacts and connections of the line switch and relay.

PRIMARY FUSE

129. If the Primary Fuse (F3) is blown, the Kvp Meter will not read until an exposure is attempted. Then it will read a constant abnormally low value, regardless of where the Kvp Selector is set. No x-rays will be produced.

130. Blown primary fuse is not necessarily an indication of electrical fault. When a fuse is blown, try another one. If it blows, the primary circuit draws higher than normal current. The possible causes are a short circuit in the primary circuit or the wires between the control panel and the tube head, and lastly, fault in the tube head.

PILOT LIGHTS

131. The Pilot Lights are permanently sealed in a plastic housing. To replace remove this snap clip on the back side of the control panel with a screwdriver. Push the light unit out from inside. Disconnect the wires. Install the new pilot light in reverse order.

KVP METER

132. Kvp Meter accuracy can be checked with a test ac voltmeter, 0-150 scale, known to read accurately. Connect the test meter across the Kvp Meter terminals. Engergize the unit and adjust the Kvp Selector until the Kvp Meter reads 80 kvp on the 15 ma scale. If the Kvp Meter is good the test voltmeter should read 68 ± 2 volts a-c. If the reading on the test voltmeter is not within the range specified the Kvp Meter should be replaced.

X-RAY CONTACTOR

133. The contacts of the X-ray contactor may occasionally require dressing. Use a fine crocus cloth or sandpaper. In some cases, a fine file can be used. Finish dressing operation by drawing a strip of white bond paper between the contacts while they are pressed together. If the contacts are pitted beyond repair or if the coil (200-ohm resistance) is open circuited, the entire contactor should be replaced.

STABILIZER

134. The stabilizer controls the average X-ray tube filament current to maintain constant milliamperage. This function is accomplished by cutting a resistor (1000-Ohm) in and out of the filament primary circuit during each useful half cycle of the ac wave. The current energizing the stabilizer coil is the high voltage current (milliamperage) taken from the midpoint of the secondary circuit of the high voltage transformer. The tension of the vibrating spring and contact spacing determines the point of the milliamperage wave at which the contacts are opened and the resistor is cut into the circuit. The stabilizer is a precision device and requires careful adjustment.

Stabilizer Check

135. Disconnect the brown wire from the MA terminal on the stabilizer. Connect this wire to the minus (-) terminal of the test dc milliammeter, 0-30 ma scale. Connect the MA terminal to the plus (+) terminal of the test milliammeter. Plug the line cable into the line receptacle and turn the Line Switch - MA Selector to 15 ma.

136. Set the Time Selector to 3 seconds and adjust the Kvp Selector to 70 kvp.

137. Press the hand switch button and read the milliammeter. It should read 15 ± 1/2 ma. Turn the Line Switch - MA Selector to 10 ma. Press the hand switch button and read the test milliammeter. It should read 10 ± 1/2 ma. If multiple heads are being powered from the control, repeat the above for each position on the Selector Switch. If the readings are within the ranges disconnect the test milliammeter and reconnect the brown wire to the MA terminal. If not, the stabilizer must be adjusted.

Stabilizer Adjustment (One Tube Head Only)

138. If the test milliammeter does not read correctly, readjust the stabilizer. CAUTION: DO NOT ADJUST THE STABILIZER WITHOUT A MILLIAMMETER IN THE CIRCUIT. DO NOT TOUCH STABILIZER DURING EXPOSURE. Remove the stabilizer cover. Back off the large adjustment screw and the small contact screw. Check the surface of the contacts to make sure they are clean and not pitted. Dress the contacts with a fine file if necessary. Tighten the large adjustment screw. As the screw is being tightened the contact end of the spring will move toward the coil yoke, and as the screw is tightened further, the contact end of the spring will start moving away from the yoke. Tighten the screw until the contact end of the spring moves away from the yoke about 1/32 of an inch (.030 - .035). Press the spring against the coil face and tighten the small contact screw until it touches the spring contact. Back off the screw approximately 1/4 of a turn or less until there is a .002 inch spacing between the spring contact and the end of the small contact screw. Use a thickness gauge to check the above spacings. It should not be necessary to loosen the nylon set screw holding the contact screw to make the adjustment. If the contact screw is loose after making the adjustment, tighten the set screw slightly.

139. Disconnect the line plug and measure the resistance of the 200-ohm variable resistor mounted to the stabilizer board. The resistance should be approximately 50-ohms. If not, set the slider on the resistor for the above resistance value. Short out the stabilizer coil by connecting a jumper between the 10 and MA terminals on the stabilizer board. Reconnect the unit to the line, turn the Line Switch - MA Selector to 10 MA and make an exposure. The test milliammeter should read 20-1/2 ± 1/2 ma. If not, readjust the slider on the 200-ohm resistor for the above tube current value. Disconnect the jumper from the 10 and MA terminals.

140. Insert the line plug into the wall outlet. Set the Time Selector to 3 seconds, and depress the Hand Switch button. The milliammeter should read 10 ± 1/2. Turn the large adjustment screw a very small amount to the left or right until the milliammeter reads 10 ± 1/2 ma. It should not be necessary to loosen the nylon set screw holding the large screw to make the adjustment. If the large screw is loose, however, after making the adjustment tighten the set screw slightly. Turn the Line Switch - MA Selector to 15 MA and make an exposure. The milliammeter should read 15 ± 1/2 Ma.

141. Higher ma than normal can be caused by a faulty C1 capacitor. To check, disconnect one of the capacitor leads from the terminal on the bakelite board. Make another exposure. If lower ma than previously read is obtained, the capacitor is faulty and must be replaced. If the capacitor is good, reconnect to the terminal.

142. Remove the test milliammeter and reconnect the Brown wire to the MA terminal. Replace the stabilizer cover.

Stabilizer Adjustment (Multiple Tube Heads)

143. If the test milliammeter does not read correctly, readjust the stabilizer. CAUTION: DO NOT ADJUST THE STABILIZER WITHOUT A MILLIAMMETER IN THE CIRCUIT. DO NOT TOUCH STABILIZER DURING EXPOSURE. Remove the stabilizer cover. Back off the large adjustment screw and the small contact screw. Check the surface of the contacts to make sure they are clean and not pitted. Dress the contacts with a fine file if necessary. Tighten the large adjustment screw. As the screw is being tightened the contact end of the spring will move toward the coil yoke, and as the screw is tightened further, the contact end of the spring will start moving away from the yoke. Tighten the screw until the contact end of the spring moves away from the yoke about 1/32 of an inch (.030 - .035). Press the spring against the coil face and tighten the small contact screw until it touches the spring contact. Back off the screw approximately 1/4 of a turn or less until there is a .002 inch spacing between the spring contact and the end of the small contact screw. Use a thickness gauge to check the above spacings. It should not be necessary to loosen the nylon set screws holding the contact screw to make an adjustment. If the contact screw is loose after making the adjustment, tighten the set screw slightly.

144. Disconnect the line plug and measure the resistance of the 200-ohm variable resistor mounted to the stabilizer board. The resistance should be approximately 50-ohms. If not set the slider on the resistor for the above resistance value. Short out the stabilizer coil by connecting a jumper between the 10 and MA terminals on the stabilizer board. Reconnect the unit to the line, turn the Line Switch - MA Selector to 10 ma and make an exposure. The test milliammeter should read 20-1/2 ± 1/2 ma. If not, readjust the slider on the 200-ohm resistor for the above tube current value. Repeat for each tube head. The test milliammeter should read 20-1/2 ± 1/2 ma for each tube head. If not readjust the slider on the 200-ohm resistor until the ma readings for all tube heads are as close as possible to 20-1/2 ma. Disconnect the jumper from the 10 and MA terminals.

145. Insert the line plug into the wall outlet. Set the Time Selector to 3 seconds, and depress the Hand Switch button. The milliammeter should read 10 ± 1/2. Turn the large adjustment screw a very small amount to the left or right until the milliammeter reads 10 ± 1/2 ma. It should not be necessary to loosen the nylon set screw holding the large screw to make the adjustment. If the large screw is loose, however, after making the adjustment tighten the set screw slightly. Turn the Line Switch - MA Selector to 15 Ma and make an exposure. The milliammeter should read 15 ± 1/2 Ma. Repeat above for all tube heads.

146. Higher ma than normal can be caused by a faulty C1 capacitor. To check, disconnect one of the capacitor leads from the terminal on the bakelite board. Make another exposure. If lower ma than previously read is obtained, the capacitor is faulty and must be replaced. If the capacitor is good, reconnect to the terminal.

147. Remove the test milliammeter and reconnect the tube head cable wire to the MA terminal. Replace the stabilizer cover.

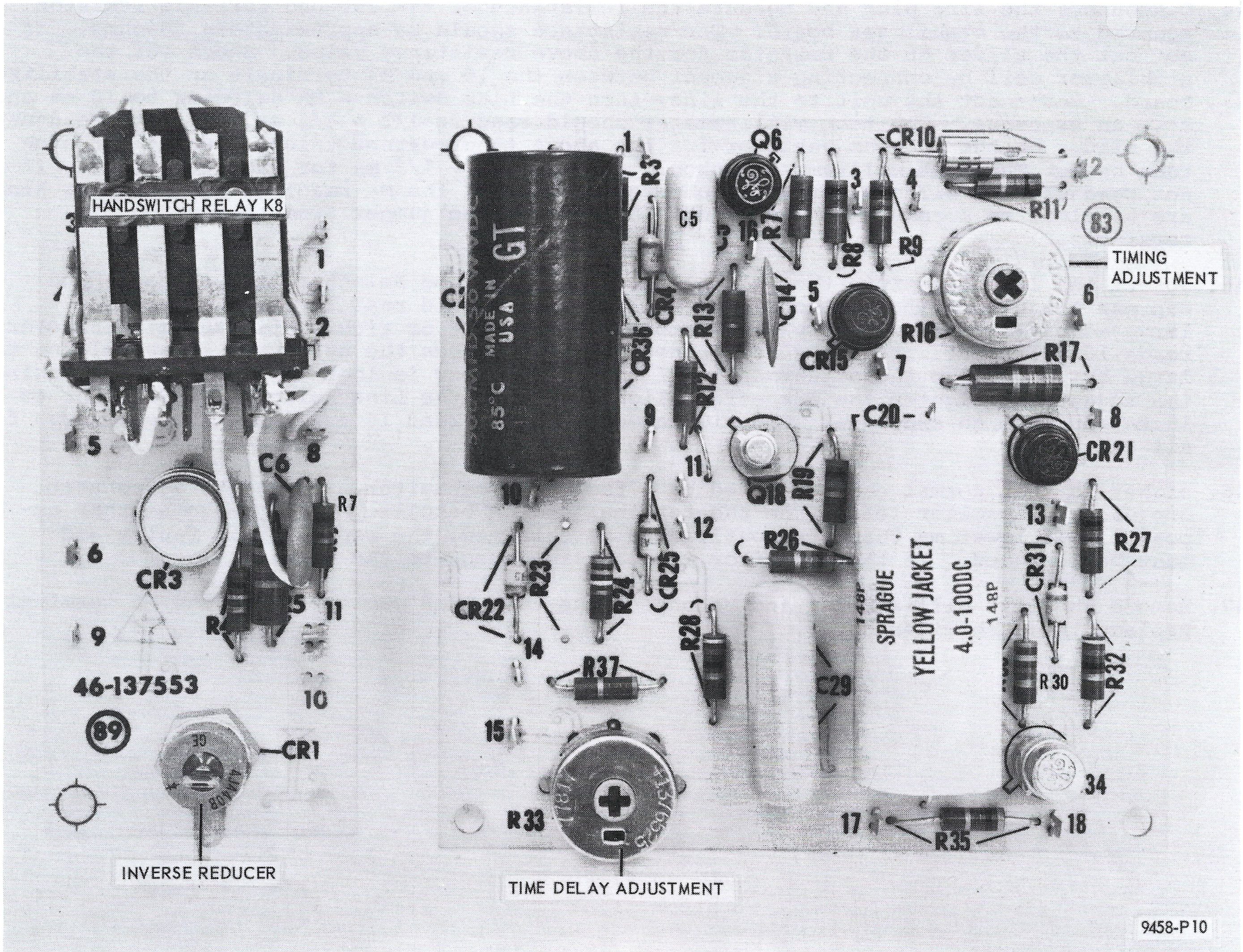

HANDSWITCH RELAY K8
TIMING ADJUSTMENT
INVERSE REDUCER
TIME DELAY ADJUSTMENT
CR1
CR3
C6
R7
46-137553
89
83
Q6
CR10
R3
C5
R7
R8
R9
R11
R13
C14
R16
CR15
R17
C20
CR21
R12
CR36
CR4
C2
Q18
R19
R26
R27
CR31
CR22
R23
R24
CR25
R28
R37
C29
R30
R32
R33
R35
SPRAGUE
YELLOW JACKET
4.0-100DC
9458-P10

ILLUSTRATION 24

TIMER

Timer Check

148. Set the Time Selector to 3 seconds. Secure a stop watch or use the sweep second hand of a regular watch to check the timing. The time of exposure can be measured by listening to the X-ray contactor or observing the exposure pilot light. Depress the Hand Switch button. After a 1/2 second time delay the exposure will start. The start will be evidenced by the clicking noise associated with closing of the X-ray contractor or by the exposure light being energized. The end of the exposure will be signaled by the second clicking noise of the X-ray contactor or by the exposure light being extinguished. The time between these events should be within 3 ± .06 seconds as an average for three consecutive exposures.

149. Exposures at other time settings can be assumed to be correct if the above test is satisfactory. If for some reason it is desired to check the timing at other settings, use a cycle counter. For short exposures up to 16/60 second a spinning top may be used.

Timer Adjustment

150. If the time of the exposure is outside the 3 ± .06 second limits, at the 3 second time setting, the R16 Time Calibration Potentiometer on the timer board, Ill. 24 must be readjusted. Turn the slotted shaft a small amount at a time - clockwise to increase the time of exposure, counterclockwise to decrease it. Recheck the timing and readjust until it is correct.

Timer Function

151. The function of the timer is to energize the X-ray contactor relay, starting the exposure, and after a predetermined period of time has elapsed, to de-energize the X-ray contactor, ending the exposure. When the hand switch button is pressed relay K8 on the timer board, Ill. 24 will pull in, energizing the Timer. The Timer will automatically start and stop the X-ray exposure.

Timer Trouble Shooting Procedure

152. If the timer fails to energize the X-ray contactor after the hand switch button is pushed, check to see that relay K8 on the timer board has been energized. If relay K8 is not energized, check fuses F1 and F2 and the hand switch circuit for continuity.

153. If relay K8 is energized, but the timer fails to energize the X-ray contactor, clean all contacts on relay K8 by drawing a piece of white bond paper between the contacts while they are held closed. Check all the wiring on the two timer boards for loose or broken connections.

154. If the above checks fail to resolve the problem, the time delay adjustment potentiometer (R33) may be out of adjustment. Mark the exact position of slotted shaft so that it can be returned to the original position if the adjustment fails to resolve the problem. Turn the slotted shaft in 1/4 turn increments, first in one direction and then in the other. Attempt to initiate an exposure after each increment. If this does not resolve the problem, return the shaft to its original position.

155. If the timer fails to end the exposure, or if the timing is erratic, check all the wiring on the larger timer board for loose or broken connections. Be sure to check the timing capacitor C20.

TUBE HEAD

156. When suspecting tube head trouble, first make sure the control unit is operating properly and that the connecting wires from the control unit to the commutator and from the commutator to the six terminals on the tube head are in good condition. See the maintenance manual for a detailed trouble shooting procedure.

157. Repeated sputtering or cracking noise in the tube head can be taken as a sign of trouble in the tube head. Depending on severity and duration of this phenomenon, it is likely that the Primary Fuse in the control unit may blow. These manifestations may be caused by a gassy X-ray tube or a high voltage breakdown in the tube head. Failure to produce x-rays may be caused by an open circuited filament in the X-ray tube.

158. Faulty tube head should not be repaired locally but returned to the nearest General Electric Dental Repair Shop for service. To remove the tube head, remove the brush contact assembly cover, and the two screws at the top and bottom of the assembly. Pull the brush contact assembly out. Holding the tube head, unscrew the two head mounting pins and remove them. Remove the tube head and the fork from the distal bracket. See Ills. 18 and 19.

OPERATION AND TECHNICS

159. Refer to Direction 13150 and 13156 for operation instructions and suggested radiographic technics.